ARMOR AT WAR SERIES

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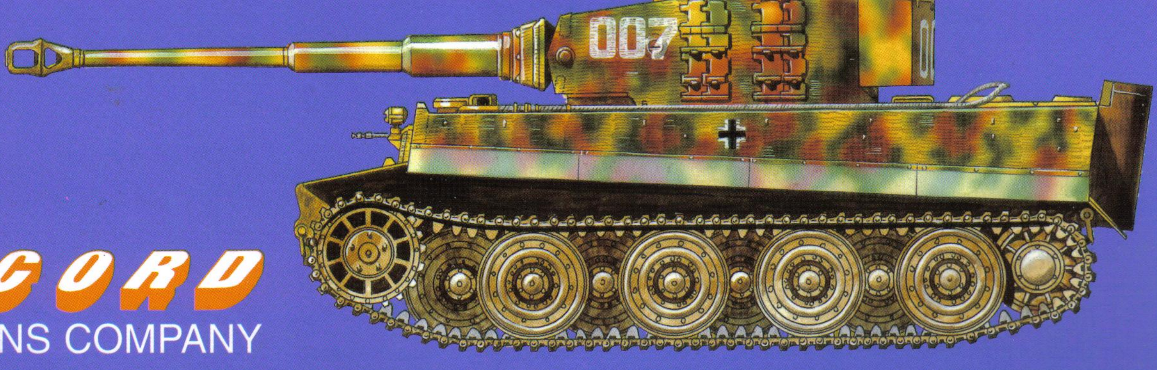
D-Day
TANK WARFARE

ARMORED COMBAT IN THE NORMANDY CAMPAIGN JUNE-AUGUST 1944

Steven J. Zaloga and George Balin



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603-609 Castle Peak Road
Kong Nam Industrial Building
10/F, B1, Tsuen Wan
New Territories, Hong Kong

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ISBN 962-361-604-X
Printed in Hong Kong

Introduction

Although the battles in Normandy in the summer of 1944 are most famous for the amphibious assault that initiated the campaign, subsequent campaign hinged around armored warfare. This book takes a look at the campaign from the initial 6 June 1944 landings through to the two key events which concluded the campaign: the destruction of most of the German armored forces in Normandy at the Falaise Gap, and the liberation of Paris. The coverage in this book is slanted towards the Allied side since the German tank forces in the Normandy battles have been so well documented in such books as Panzers in Normandy (After the Battle, 1983) and the many Editions Heimdal books from France. The authors would especially like to thank David Fletcher, the librarian at the RAC Tank Museum at Bovington Camp, for his generous help in selecting and obtaining the photos of the British armor which appear here. Thanks also go to Frank DeSisto at the USS Intrepid Museum in New York City for other help in finding photos, and to Russ Vaughan for help with reference material.

Operation Overlord

The Normandy campaign can be broken down into three main phases. The first stage was the amphibious assault itself, a monumental undertaking on a scale never before attempted. Tanks played a small role in the landings, though many specialized types were developed, especially by Britain, to assist in capturing the beach-head. The next stage was securing and defending the beach-head. When the Allied forces landed at Normandy, they were substantially outnumbered by German forces in the region, particularly in tanks. The German forces were handicapped for three reasons in crushing the beach-heads using tanks. First, the German strategic appreciation for Allied intentions was fatally flawed. The German high command expected the main amphibious assault to come in the Pas de Calais area, where the English Channel is narrowest. They concentrated their panzer forces in that area, leaving Normandy weakly defended. The Allies continued to successfully deceive the Germans even after the 6 June 1944 landings in Normandy, and the German high command was reluctant to commit their armored strength against a landing that they still thought was a diversion from the main assault. Second, Allied air power was dominent, and played a vital role in delaying and damaging German panzer forces, even when the German high command did commit its panzer forces into battle. Third, the terrain in the western sector, held by the American First Army under Gen. Omar Bradley, was not well suited to tank operations either by the Allies or the Germans. The area is criss-crossed by dense hedgerows, called *bocage* in French, which helped shelter the farm fields from the erosion of the harsh sea breezes. The only area where the terrain was suitable for tank fighting was in the eastern zone, held by the British and Canadian 2nd Army under Lt. Gen. Miles Dempsey. This area was also nearest to the German tank concentrations, and was the scene of the heaviest tank fighting in June and July as the initial attempts were made to break out of the beach-head.

The third phase of the operation was the breakout which began in mid-July a little over a month after the main landings. This was a two-pronged affair, with the Americans staging Operation Cobra towards St. Lo, and the British/Canadian forces conducting Operation Goodwood towards Caen and beyond. The Germans attempted to stop the break-out attempt with their own offensive near Mortain, but this only led to their forces becoming encircled and sealed off when the enveloping Allied armies closed the noose near the Falaise Gap. The culmination of the Normandy campaign came with the liberation of Paris in on 25 August 1944, with the French 2nd Armored Division in the lead.

Operation Neptune

The Normandy invasion plans, called Operation Neptune, consisted of an amphibious assault against five beaches. The US VII Corps landed on the western-most beach, codenamed Utah; the US V Corps landed to its east at Omaha beach. The British XXX Corps landed in the center at Gold Beach, with Canadian elements of the I Corps at Juno and the British divisions at the easternmost beach, codenamed Sword.

The opposing German forces were most heavily concentrated in the Pas de Calais region to the east. In the immediate Normandy region, the beaches were held by three infantry divisions well protected in a complex assortment of bunkers and concrete firing pits. The main armor concentration, *Panzer Gruppe West*, had only the 21. Panzer Division in the immediate area, located to the south-east of Caen in the British sector with 127 Pz.Kpfw. IV tanks and 40 StuGs. The Panzer Lehr Division was in the Chartres area, 100 miles away; and 12.SS-Panzer Div. (Hitlerjugend) near Rouen, 70 miles to the north east. The lack of German tanks in the immediate beach area was due to terrain and to strategic decisions by the German high command. The terrain near the beach was not well suited to tanks due to the *bocage* and the presence of many tidal marshes and rivers. The Germans had also learned from the Sicily and Anzio battles that panzer forces near invasion beaches were very vulnerable to naval gunfire. The Allies launched an intensive air campaign against road and rail nets in the beach area to hamper any movement of German panzer divisions into the beach-head.

In the American sector, the plan was to land two tank battalions at each beach in support of the infantry divisions there. Any more tanks were judged to be too much since they would lead to beach congestion. A third battalion was kept in reserve for each beach. These battalions generally, with some exceptions, left their M5A1 light tank company back in England or on the landing ships. There were two ways to land the M4 medium tanks on the beach. The British Army devised an amphibious conversion kit for the M4 called the DD tank, for Duplex Drive. The US produced a number of kits based on British plans, and obtained additional kits from British sources to equip portions of each tank battalion committed to Operation Neptune. The second method for landing the medium tanks was to fit them with deep wading trunks. This allowed the tanks to be driven ashore with the tank almost completely submerged except for the top of the wading trunks, which provided air to the engine. The US Army did not develop any specialized combat engineer tanks, aside from bulldozer tanks, comparable to those employed by the British 79th Armoured Division. Engineer operations were to be conducted only by unprotected combat engineer squads. The lack of armored combat engineer support proved to be a costly mistake at Omaha beach.

Utah Beach was the objective for the 70th and 746th Tank Battalions. The 70th had two companies of DD tanks, and one company of normal M4s fitted with wading trunks, including four dozer tanks. The 70th Tank Bn. was the first to land in Wave 1A, with its DD tanks launched 3,000 yards from shore from LCT's. A total of nine tanks were lost in the water, 5 DD tanks and 4 wading tanks. The 746th Tank Bn. was equipped entirely with M4 medium tanks fitted with deep water wading trunks. It landed without difficulty directly onshore without loss. Once on the beach, the tanks were hemmed in by flooded tidal areas behind the beaches. Eventually, the tanks were able to eliminate German anti-tank guns and move inland over several narrow causeways. The small 75mm guns on the M4 medium tanks proved unable to destroy heavily reinforced German pillboxs, but their suppressive fire was helpful to the infantry. By the end of the day, the 70th Tank Bn. had lost a further 7 tanks to mines or German anti-tank guns, while the 746th lost 2. Utah beach was securely in Allied hands, and the US infantry units were moving foward beyond the beaches as planned.

The situation at Omaha beach was far worse. The water conditions off Omaha beach were much choppier than off Utah beach. Like the 70th Tank Battalion, both the 741st and 743rd Tank Bns. had two companies of DD tanks and one of normal tanks with wading trunks. The tanks were supposed to be launched 5,000 yards from shore so that the LCTs would not be exposed to German coastal guns while stationary in the water. This proved to be a mistake due to the strong wave action. Of the 32 DD tanks in the 741st Tank Bn., 27 sank after encountering high swells, 3 became stuck on their LCT landing craft and could not be launched, and only 2 swam in to shore. The 743rd didn't even attempt to put their DD tanks into the water, and simply landed them ashore. Aside from 8 tanks from the 743rd lost when their LCTs were sunk by German shore guns, all the others were landed. In total, 96 tanks were landed at Omaha beach within the first hour of the landing. Omaha proved to be much more heavily defended than any other Normandy beach. The Germans had position 50mm and 88mm guns in pillboxes along the beach which had clear fields of fire along the beach. As a result, the anti-tank guns were able to knock out the M4 medium tanks by hitting their thinner side armor. In the case of the first tanks from the 741st Tank Bn. to land, all three were knocked out by anti-tank guns within moments of wading ashore from their LCTs. Nevertheless, the small number of surviving tanks provided invaluable support to the hard-pressed infantry. The commander of 2/116th Infantry said that the tanks "saved the day. They shot the hell out of the Germans and they got the hell shot out of themselves." Movement off the beaches at Omaha proved to be the most difficult of any of the beaches owing to the presence of a 100 foot high escarpment. The several ravines leading off the beaches were blocked by obstacles and German pillboxes which were methodically reduced, at great loss, by engineer teams and naval gunfire with some tank support. By early afternoon, the infantry was finally fighting its way over the bluffs above the beaches, but at considerable loss. Nevertheless, by the end of the day, Omaha was firmly in Allied hands.

The Overlord plan envisioned landing a much larger armored contingent on the eastern beaches, since it was presumed that the initial breakout attempts would be conducted in this sector. The best known element of the armored contingent was the 79th Armoured Division, nicknamed Hobart's Funnies after the commander who had inspired the concept of a special purpose armored unit. In view of the difficulties operating tanks during the Dieppe raid in 1942, Maj. Gen. Percy Hobart proposed a variety of special purpose armored support vehicles (called "Funnies") to assist both infantry and armored units in conducting an opposed landing. Dieppe had been a painful reminder that landing armor on a European beach was not as easy as it seems, since shoreline features, such as shingled beaches, could stop tanks as certainly as tank obstacles. The difference between the favorable British attitudes towards specialized armor and the unenthusiastic American attitude was due to a combination of the British tradition of gentlemanly amateurism and the Dieppe experience and the US Army's lack of experience with contested landings. The lessons learned from US Army and Marine Corps amphibious landings in the Pacific theatre do not seem to have filtered through to the European theatre. As a result, the British were far better prepared for the landing than their American allies, even though the Americans were offered British equipment.

At each of the British/Canadian beaches, the infantry assaults were preceded by a wave of DD tanks: the Nottinghamshire Yeomanry and 4/7th Royal Dragoon Guards at Gold, the 6th and 10th Canadian Armoured Regiments at Juno, and the 13/18th Hussars at Sword. In general, the sea conditions were far better than at Omaha, and most DD tanks managed to swim ashore. For example, 13/18th Hussars got 33 of their 40 DD Shermans to the beach. The next armor came from the Royal Marine Armored Support Regiments. This consisted of LCT (A)s loaded with two Centaur IVs in the front and a Sherman behind as a control tank. The Centaurs were placed to allow them to fire while approaching the beach, acting as mini-gunboats. The 1st Battery landed at Gold, 2nd at Juno and 5th at Sword. The armored LCTs they employed proved to be unseaworthy and as a result only 20 of eighty Centaur IVs arrived by H-Hour, and 28 more later in the morning. The third wave of armor ashore were the breaching teams of the Westminster and 22nd Dragoons with Sherman Flail tanks and the 5th and 6th Assault Regiment Royal Engineers, equipped with Churchill AVRE engineer combat vehicles. The AVRE's were fitted with bobbins at the front to lay paths over the slippery blue clay in the beach area. Even more valuable were their Petard launchers which fired massive "Dustbin" projectiles to destroy German bunkers. Unlike Omaha, where the US tanks were often unable to silence pillboxes, the AVREs quickly silenced them with the ferocious blast of the Dustbins. The British and Canadian armor methodically went about its task of breaching the defenses, and the beach-heads were taken with unexpectedly light casualties. The British 2nd Army had enjoyed the advantages of better assault tactics as well as some terrain advantages, especially the lack of any escarpments of the type that so hindered the US Army landing at Omaha.

Following the specialized armor was a great deal of additional support arrived later in the day or on D+1. This included the 7th Armoured Div. and 33rd Armoured Bde. at Gold, the Canadian 2nd and 4th Armoured Bdes. at Juno and the 27th Armoured Bde. at Sword. The German response in the first day of the fighting was mostly confined to infantry units in the immediate beach area. US tank units encountered a handful of old Renault 35.R light tanks near Utah beach, which were easily destroyed.

The commander of Army Group B, Gen. Erwin Rommel, believed that the most prudent approach to the landings was to crush them with armor immediately. The theatre commander, Field Marshal Gerd von Rundstedt did not agree with placing the armor forward, fearing the power of naval gunfire as had been demonstrated at Sicily and Anzio. The 21.Panzer Division had some of its forward-deployed units in the sector between Juno and Sword beach and learned of the landings from captured British paratroopers. But the divisional commander refused to commit them until morning. By late morning, the main tank concentrations of 21. Pz.Div. began moving forward from the Falaise area, and the division was soon subordinated to the I.SS-Panzer Korps headquarters in the area. At 14:30, Hitler authorized the transfer of the 12.SS-Panzer Div. *Hitlerjugend* and Panzer Lehr Div. from strategic reserve, and they began moving towards the landing zones. The I.SS-Pz.Korps commander was ordered to "attack from the vicinity of Caen and drive the British into the sea." In fact, only the 21.Pz.Div. was available, with the 12.SS-Pz. Div. not expected to arrive until 7 June and the Pz.Lehr on 8 June. The 21.Pz.Div. moved north of Caen and was struck by several Allied air attacks so that by late afternoon, only 70 of the division's original 124 Pz.Kpfw. IV tanks were operational. At least 13 more were knocked out in a one-sided encounter with the anti-tank guns and artillery supporting the Staffordshire Yeomanry along the road to Caen. By early evening, some German tanks slipped quite close to the beach near Lion-sur-Mer, but were forced to withdraw when it became evident that British airborne troops were threatening to cut them off. By the end of the day, the Allies managed to land about 156,000 men, and over 500 tanks, with many more coming in the following waves. German armor had failed to seriously contest the landings.

Securing the Beach-Heads

The 12.SS-Panzer Div. arrived in the beach-head area on D+1 (June 7) and immediately launched an attack against the 3rd Canadian Div. In the ensuing fighting, the Pz.Kpfw. IVs of 1./SS-Pz.Rgt.12 struck the 27th Canadian Armd. Bde. and knocked out 28 Shermans for a loss of only six tanks. Nevertheless, the attack was repulsed and never posed a serious threat to the beaches. On the morning of 8 June, the I.SS-Pz.Korps ordered an attack by both available panzer divisions against advancing British and Canadian forces. However, the progress of the Canadians had been so steady, that tanks, supported by the 26.SS-Pz.Gren. Rgt. were committed at dawn before the attack could be fully organized. This battle group struck the Regina Rifles and Royal Winnipeg Rifles, but was eventually beaten off. Through the day, the Pz. Lehr Div. tried to move into the Normandy area along five separate roads, but was hit repeatedly by air attacks leading to the loss of about 80 armored vehicles including Sd.Kfz. 251 infantry half-tracks, SP guns and half-track prime movers. The Germans continued to counter-attack the advancing British 2nd Army with their three panzer divisions. On 9 June 1944, a battle group from the 21.Pz.Div. struck British positions of the 3rd Division near Longueval, trying to force a gap between British forces at Sword beach and the Canadians at Juno.

There was very little German armor in the American sector until the 17.SS-Pz.Grenadier Div. began arriving on 8 June. The bocage in the American sector was ill-suited to tank movement and so the Germans intentionally avoided deploying any susbstantial tank force in the area. While the British and Canadians advanced on Caen in the face of the German panzer divisions, the American infantry, with modest tank support, began to fight to the northwest to capture the key port of Cherbourg.

The German theatre commander, Field Marshal Gerd von Rundstedt, ordered three additional panzer divisions to begin to move into Normandy: the 2.Pz.Div. from Amiens, the 1.SS-Pz.Div. from Belgium and the 2.SS-Pz.Div. (Das Reich) from Tolouse in southern France. On 11 June, Hitler authorized the transfer of the 9. and 10.SS-Panzer Divisions from the Eastern Front to Normandy. This would provide the German forces in the beach area with somewhat more armored forces than the Allies, about 8 divisions vs. 5 by early July, but the Allies had a decided advantage in infantry, artillery and air support.

Even by the second week of June, both sides realized that the city of Caen would be the fulcrum for further actions in the British sector. Most of the heavy tank fighting in June and early July would be focused around this Norman town. The 21st Army Group commander, Field Marshal Bernard Montgomery, had expected to seize Caen on D-Day itself; it would in fact take over a month of tough fighting due to the presence of German panzer forces. The fighting towards Caen was intense and bloody as the German forces contested every kilometer of ground.

Villers Bocage

On 12 June, the 7th Armoured Division, the legendary "Desert Rats", began to attack towards Caen from the west via the town of Villers Bocage in an attempt to outflank the Pz.Lehr Div. The attack was spearheaded by Brigadier Robert "Looney" Hinde's 22nd Armoured Bde. which charged through Caumont early on 13 June with little opposition. Unbeknownest to the British, the Germans had moved up the s.SS-Pz.Rgt. 101 with 37 Tiger I tanks on 12 June, and they were sitting near Hill 213. The 1st company was commanded by the legendary German tank ace, *Obersturmfuhrer* Michael Wittmann, who claimed to have destroyed 119 Russian tanks on the Eastern Front. Wittmann led an attack by four Tiger tanks and one Pz.Kpfw. IV at the rear of the British column from 4th CLY Sharpshooters taking a break in the town of Villers Bocage itself. In short order, three Cromwells were quickly destroyed. On heading west outside the town, Wittmann's tank was hit frontally by a 17 pdr. Sherman Firefly which did not penetrate. Seeing he was outnumbered, Wittmann retreated back into the town where his Tiger was hit twice, without effect by a surviving Cromwell. Wittmann's Tiger quickly knocked out the Cromwell. Wittmann then turned his attention to a British column east of the town, proceeding to shoot up the unsuspecting A Squadron. In the meantime, B Squadron, with its Sherman Firefly tanks, moved into Villers Bocage from the west to ambush Wittmann's group should it return. Sure enough, Wittmann's group proceeded back into the town, probably expecting to encounter B Squadron to the west. Instead, the Shermans with additional support quickly shot up the entire column. Wittmann and his crew managed to escape their burning tank. In total, Wittmann's group managed to destroy 20 Cromwell tanks, 4 Shermans, 3 Stuarts, 14 half-tracks and 14 Universal Carriers, effectively bringing the British offensive to a halt. Any further action in the sector was cancelled when it became evident that the 2.Pz.Div. had arrived opposite the 7th Armoured Div.

After nearly two weeks of fighting, the British 2nd Army had failed to capture Caen or press ahead to the northeast and seize any of the ports up to Le Havre. The attacks were temporarily halted and not resumed for another week. Montgomery had hoped for better results from the 7th Armoured Division, counting on their battle experience. Instead, the division proved to be battle-weary. In a post-war interview, the British 2nd Army commander, Gen. Dempsey, angrily opined that "the 7th Armoured Division was living on its reputation and the whole handling of that battle (Villers Bocage) was a disgrace." But it would be another month before Dempsey would sack the divisional commander and most of the division's top staff.

Tiger vs. Sherman

The combat at Villers Bocage highlighted the technical disparity between the Allied and German tank forces. The majority of the Allied tanks were armed with a short 75mm gun that was effective in dealing with the Pz.Kpfw. IV tank, which made up about half of the German strength in France. However, this weapon was completely ineffective in frontally engaging either the Panther or Tiger tank. The British had begun adding one Sherman Firefly tank, armed with the long 17 pdr. gun to each troop (one of four). This gun could penetrate the Panther and Tiger frontally at the right angle, but as was evident at Villers Bocage, this was not assured. Had the first 17 pdr. hit knocked out Wittmann's Tiger, British losses might not have exceeded the first three Cromwells. The US Army was even more poorly prepared to handle the German tanks. The US Army had turned down an offer to build the 17 pdr. in the US for logistical reasons, its new 76mm gun was available only in small numbers, and the 76mm gun was not as effective as the 17 pdr. The 76mm gun was nearly useless against a Tiger frontally, though it could penetrate the side armor. Luckily for the Americans, the British and Canadians bore the brunt of the tank fighting during the first month of fighting, as most German armor was concentrated around Caen.

Operation Epsom

Von Rundstedt concentrated most of his attention around Caen since it posed the most immediate threat of breaking out into the better country around Falaise. In addition, the Germans were still confident that with enough armor, they could launch a stinging counterblow against the beaches that would doom the Allied landing. While focusing on Caen, the US Army was methodically fighting its way up the Contentin peninsula with infantry. By the middle of June, the US Army was poised to seize the key port city of Cherbourg, immensely simplifying the logistical burden of the Allied forces. US forces continued to be strengthened, with the arrival of several fresh US Army armored divisions including the 2nd, 3rd, 4th and 6th.

In the British sector, additional reinforcements had arrived over the Normandy beaches from the UK by mid-June, including the British 11th Armoured Div. This brought the strength of the new British VIII Corps to about 600 tanks. Facing them, Geyr von Schweppenburg's Panzer Group West had about 228 tanks in the 12.SS-Pz.Div., 21.Pz. Div. and Pz. Lehr Div. plus a lethal assortment of 75mm and 88mm anti-tank guns. An offensive from the western flank of the British 2nd Army, codenamed Operation Epsom, started on 24 June under rain soaked skies to the west of Caen. There were particularly sharp engagements between the Shermans of the 29th Armoured Bde. and the Panthers of the 1./SS-Pz.Rgt. 12. The attack succeeded in penetrating south over the Odon River, but was eventually halted at Hill 112. On the night of 29 June, the Germans launched a major counterattack in the sector by the 9. and 10. SS-Pz. Divs. of the II.SS-Panzer Korps. The British 15th Division beat off the tank attacks during intense fighting north of Gavrus. This attack made it clear that the Germans were no more successful than the British attacking in this confined terrain. The operation caused the British terrible infantry losses; for example the stalwart 15th Division lost nearly half of its infantrymen in Epsom's four days of fighting. Unfortunately, Operation Epsom did little to break the stalmate in the fighting near Caen. The doggedness of the British attacks and the failure of their own II.SS-Pz.Korps counterattack on 29 June convinced many German commanders that it would be wiser to pull out of the Caen salient for more defensible positions, a suggestion that Hitler angrily dismissed.

The northern half of Caen was finally wrested from the Germans on 10 July during a broad-front attack called Operation Charnwood. Rather than risk suffering heavy infantry losses, the battle was initiated by a massive carpet bombing by Lancaster heavy bombers. The bombers caused immense destruction to the Germans stationed on the approaches to Caen, and was a tremendous morale booster to the British troops.

The British success led to Field Marshal von Rundstedt's replacment as the OB West commander, and there were rumors afloat that Hitler was not happy with the performance of Rundstedt's main field commander, Erwin Rommel of Army Group B, who was viewed at headquarters as "defeatist". The Germans retained their main panzer force near Caen since they still hoped to launch a major counter-attack to shatter the Allied bridgehead. Caen was the only practical location for such an operation since the American sector was even more restrictive due to the dense *bocage*. Von Rundstedt's limited counter-actions had failed, and time was working on the Allies' side. The Soviet had launched a major offensive in Byelorussia called Operation Bagration, that threatened to unhinge the whole Eastern Front. By July, the German army was now facing simultaneous defeats in both East and West.

Operation Goodwood

By early July, the leadership of the US Army had become dismayed by Montgomery's slow progress in the Caen area; there was genuine concern that the campaign was beginning to turn into a bloody war of attrition like World War I, with futile tank charges against entrenched guns like the futile infantry charges against machine guns three decades earlier. The costly infantry fighting in the bocage of the Contentin peninsula convinced the Americans that they had to escape the terrain restrictions of the coastal area to break the stalmate. Gen. Omar Bradley, commander of the US 1st Army, began plans for Operation Cobra on 11 July, aimed at rapidly striking south around St. Lo and Coutances. American forces in the sector had continued to expand so that late July, Bradley became commander of the enlarged 12th Army Group; Lt.Gen. C.H.Hodges took over 1st Army and Gen. George S. Patton was assigned the new 3rd Army. In preparation for the breakout, Bradley made his first committment of the US armored divisions, using the 2nd and 4th Armored Divs. to help in pushing the German line south towards Coutances and St. Lo where the terrain began to improve. This activity forced the Germans to begin shifting some of their armor into the American sector, moving the Panzer Lehr Div. near St. Lo, and the 2.SS-Panzer Div. near Periers.

While Bradley was planning Cobra, Field Marshal Montgomery and Gen. Dempsey, the British 2nd Army commander, were planning a similar operation of their own, Operation Goodwood. This attack was aimed not only at seizing Caen, but breaking past the German anti-tank gun line on the Bourguebas ridge and into the Caen-Falaise plains beyond. The attack would be launched to the east of the city, rather than in the western area where so many previous attacks had been launched and failed. By this stage, the British alone had three armoured division in Normandy (7th, 11th, Guards), five armoured brigades and three independent tank brigades totalling 2,250 medium and 400 light tanks. In addition there was a substantial Canadian force including the 4th Armoured Division, and the allied Polish 1st Armoured Division. Goodwood would be preceded by the most massive bombing raid of the campaign, delivering some 7,000 tons of bombs on the main German defensive positions. The bombing attacks had very mixed results, some German tanks units such as the Tigers of s.Pz.Abt. 503 and 4/Pz.Rgt. 22 taking heavy losses. The 88mm guns of the 16th Luftwaffe Field Division near Cagny had survived the worst of the pummeling. The attack began on 18 July spearheaded by 750 tanks of the 7th, 11th and Guards Armoured Divisions.

Goodwood revealed the continuing troubles in British armored tactics which still tended to rely on tank charges for penetration, rather than on infantry penetrations of the main line of resistance followed by tank exploitation. This was partly due to the experiences of the desert war in North Africa. But in Europe, such tactics would prove to be costly and unsuccessful. Furthermore, the terrain south of Caen was considerably different that the confined terrain closer to the beaches. The area was flat and the Germans had large avenues of fire for their superior long range anti-tank and tank guns. Among the first units raked with 88mm fire was the 11th Armd. Div.'s 29th Armoured Bde., which lost 16 tanks in a matter of minutes. A single battery of four Luftwaffe 88mm guns knocked out about 40 British tanks with side shots, without the battery once being attacked by infantry. The 7th and Guards Armoured Divs. were delayed by minefields and congestion, with the 11th Armoured Division becoming exposed at the point, and ground down on the approaches to the Bourguebas ridge.

The fighting in the afternoon and evening of 18 July was the largest and most intense tank fighting of the Normandy campaign to date. The Germans were significantly outnumbered, but enjoyed the advantages of prepared positions and the longer range firepower of their Panther and Tiger tanks. Casualties in the 11th Armoured Division were horrendous, amounting to 126 tanks or half its strength. The attack faltered, and the British units lost about 200 tanks on the first day alone. The German losses to the bombardment and tank fighting were also grave: 109 tanks in the 21. Pz. Div. and 1.SS-Pz.Div. alone. By the end of the operation on 22 July, more than 400 British tanks had been lost, leading one British historian to label Operation Goodwood "the death ride of the armoured divisions". The Goodwood assault cleared the Germans from Caen but only penetrated about seven miles, leading Gen. Eisenhower to remark bitterly that the Allied air forces could not afford to drop 1,000 tons of bombs for each mile to be gained. Yet because of the dogged British and Canadian attacks around Caen, the Germans remain fixated on the eastern sector of the bridgehead.

Operation Cobra

The Germans were expecting American actions in the western sector, but were unprepared for the scale or ferocity of the attack. At the time, two German panzer divisions (Panzer Lehr and 2.SS-Panzer) of the eight deployed in Normandy were facing the US Army sector, and they were down to about 109 tanks and about 40 assault guns. The US forces included four full strength armored divisions (2nd, 3rd, 4th, and 6th) and several separate tank battalions and tank destroyer battalions, with another division (the 7th) scheduled to arrive. On 24 July, Allied bombers began to carpet-bomb in key sectors in front of 1st Army, the opening move of Operation Cobra. In total tonnage, the Cobra bombardment was only about half as intense as the Goodwood strikes, but they proved far more effective in paving the way for the assault that followed. The heaviest blows fell on the main German panzer force in the sector, the Panzer Lehr Div. Within moments, the carpet bombing managed to render about 70% of Pz. Lehr ineffective, with many soldiers stunned and insensible due to the intensity of the attack.

The US Army tactics for penetration were different from the British approach, with the initial breach being accomplished by two infantry divisions. Once the breach had been accomplished, two more infantry divisions were committed to secure the area, and the 2nd and 3rd Armored Divisions charged forward to exploit the breach. A second breakthrough was then made further west near the coast, and two more armored divisions (4th and 6th) began their exploitations. Unlike the Goodwood assault, which pushed three armoured divisions through a very congested bottleneck, the four US armored divisions attacked along a broader front with far more extensive infantry to secure the breakthroughs.

At first, the German line did not crack and Bradley feared another stalemate like Goodwood. But under relentless pressure, the brittle German defenses began to collapse all along the front. In three days, the 1st Army pushed down the French coast to Avranches, trapping or destroying much of the German Seventh Army. Cobra also marked the debut of Gen. George Patton in the Normandy campaign, commanding the VIII Corps until his own Third Army was ready for action. Patton commanded two excellent armored divisions and his skill with mobile forces made him well suited for the exploitation campaign that followed.

After the disappointments and frustrations of his own failed offensives around Caen, Montgomery kept up the pressure on the Germans with Operation Bluecoat, aimed at seizing Mt. Pincon. While Montgomery planned the operation in the hopes of keeping the Germans pinned down on the eastern sector, the Germans had their own reasons for staying fixed near Caen. Hitler and his generals remained convinced that a counteroffensive against the Allies was still possible, and the Caen sector was still the only area where a mechanized attack towards the beach-head was feasible.

The American success in Brittany forced Hitler to insist that the German Army Group B to finally launch a major counterattack against the Allied advance. Instead of attacking towards the beaches and dividing the American and British forces, the attack was aimed at plunging westward from Mortain to the Atlantic coast at Avranches with an aim at cutting off and destroying the US First Army. Codenamed Operation *Luttich*, the Wehrmacht only managed to scrape up 250 tanks, instead of the 500 demanded by Hitler. The Germans began the attack towards the town of Mortain, held by the US Army's 30th Infantry Div., a National Guard unit. The main elements in the attack were the 2. Panzer Div. and the 2.SS-Pz.Div, but the Allies knew that an attack was coming from decrypted radio messages. The Luttich operation was too little, too late. The Germans underestimated the staying power of the American infantry, and despite heavy losses, the 30th Infantry tenaciously defended against the German attack. The Germans found armored operation in the bocage no easier than the Americans, and remembered why they had originally planned their offensive across the flat cornfields of Caen.

Once on the move, the German panzers found themselves very vulnerable to Allied air attack. The P-47s and Typhoons destroyed few tanks, but their incessent attacks destroyed the soft-skins and supplies on which the panzers depended and greatly demoralized the German tankers. By diverting so much their reserve armored strength away from Caen, the Germans left themselves vulnerable to encirclement from the Americans in the west and the British and Canadian forces near Caen. The new German theatre commander, Field Marshal Gunther von Kluge, was all too aware of the risks when the fresh Canadian First Army began thrusting south along the Caen-Falaise road on 8 August as part of Operation Totalize. With the German armor fatally weakened after two months of fighting around Caen and divided between the American and British fronts, the British and Canadian armored units finally began to enjoy the prospects for breaking the stalemate in the Caen sector.

End of a Tank Ace

One of the first victims of Operation Totalize was the German tank ace, Michael Wittmann, who had so hindered the British advance over a month before at Villers Bocage. On 8 August at the beginning of Operation Totalize, SS-Hauptsturmfuhrer Wittmann led several remaining Tiger I tanks of the s.SS-Pz.Abt. 101 north along the Caen-Falaise N158 road against the Allied attack. Around noon, 3 Troop, A Squadron of the Northamptonshire Yeomanry led by Lt. A. James noticed Wittmann's three Tiger Is advancing along the highway. The troop had four Sherman tanks, including a single Firefly, commanded by Sgt. Gordon. Gordon was ordered to hold his fire until the Tigers were within range, and at 800 yards, he was cleared to fire. His tank fired two rounds at the rearmost Tiger (probably Wittmann's), setting it on fire. Gordon then ordered the driver to reverse back to cover, just in the nick of time as the Tigers began firing back. While reversing back, the hatch cover over Sgt. Gordon slammed him in the head, knocking him senseless. He stmbled out of the tank and was wounded by shrapnel. Realizing that the Firefly was the only troop tank capable of dealing with the Tigers, Lt. A. James raced over to the Firefly and ordered the gunner to engage the second Tiger. With one well-aimed shot, the second Tiger brewed up as its ammunition caught fire. One of the other Shermans was already firing away at the third Tiger, which was milling around aimlessly in confusion as its mates exploded and burned. The 75mm rounds could not penetrate the Tiger, but did manage to distract the crew. The Firefly brought the third Tiger under fire, igniting its internal ammunition with two rounds and causing it to explode. The engagement took twelve minutes.

Wittmann had been unstoppable for nearly a year of tank fighting, enjoying the rare advantage of being in combat during the period of time in which the Tiger I was invulnerable to enemy tank fire. On the Eastern Front in 1943, there was no Soviet tank capable of penetrating the frontal armor of the Tiger I, while the Tiger could easily destroy Soviet T-34s at long ranges. Although Wittmann was clearly a skilled commander as shown by his rampage at Villers Bocage, the sudden appearance of a tank that could knock out the Tiger, the Sherman Firefly, meant that his days were numbered. At Villers Bocage, his Tiger was knocked out for the first time by enemy gunfire, and near St. Aignan de Cramesnil, his luck finally ran out. While much ink has been spilled over his exploits, many Allied tankers merit equal attention, for example, Creighton Abrams, battalion commander of the 37th Tank Battalion, 4th Armored Division. Abrams saw his combat debut near St. Lo in July, and he and his crew would knock out about 40 German tanks over the next six months. Unlike Wittmann, he managed to do so while commanding a mediocre Sherman tank which was decidely inferior in armor and firepower to the many Panther tanks they knocked out. Wittmann never knocked out a tank equal or superior to his own. Furthermore, Abrams was also the skilled leader of an entire tank battlion (and later a combat command), whose unit leadership was far more impressive than any gunnery scoreboard.

The Falaise Envelopment

By mid-August, the situation for the German forces in Normandy was becoming desperate. Patton's Third Army had been committed to action, and had made a bold hook from Avranches to Argentan by 12 August. The rapid American advance cut off the German Seventh and Fifth Panzer Armies in a sack stretching from Mortain back to Trun, about 20 miles long and about 10 miles wide. The only escape was eastward, and Allied aircraft were already attacking any mobile units that tried to do so. Even Hitler realized their predicament, and on 13 August authorized a pullback to Flers. The American advance came to a halt along a boundary line previously agreed between the British and Americans.

The task of closing the Falaise pocket was left to two armored divisions of the British First Army, the 4th Canadian Armoured Division and the 1st Polish Armoured Division. The Polish unit, the descendent of armored units which had fought in the 1939 Polish and 1940 French campaigns, led the way. Taking heavy losses, the 1st Polish Armoured Division managed to seize several pockets in the midst of the German retreat, most notably a hill near Chambois that the Poles called Maczuga, "the mace". The German units, desparate to escape, attacked the blocking Polish and Canadian units with incredible fury. The Polish and Canadian forward detachments were small islands amidst a sea of fleeing German troops and vehicles. The Allied aircraft extended a heavy toll on the retreating German forces, but nonetheless, many German units managed to withdraw, although without their heavy equipment. The leading units of the two armies, the Polish 10th Mounted Rifles and the US 90th Infantry, met near Chambois on 19 August. German units continued to slip past the weak cordon, but the P-47 Thunderbolts and Typhoons continued to wreak havoc on the withdrawing columns. It was one of the most horrific killing grounds of the war. In the town of St. Lambert, a single German Panther held off a Canadian tank attack, knocking out 14 Shermans before a young lieutenant managed to clamber on the tank, wound the tank commander and toss a grenade inside. By the end of the battle, over 50,000 German troops remained in the pocket along with over 10,000 dead along the Falaise corridor. There were no fewer than 500 tanks and assault guns in the pocket along with 7,500 vehicles.

The failure to close the Falaise Gap is widely regarded by many military historians as a significant operational failure that could have decisively eliminated the German army in France. The British failed to commit the bulk of their forces to close the gap, and Gen. Bradley should have insisted on a US role in closing the gap. Nevertheless, the Falaise encirclement, if not destroying all the German forces, destroyed so many that the advance on Paris had become a foregone conclusion. Some idea of the scale of the destruction suffered by German units in the Normandy campaign can be gathered by comparing the strength of these units in early June at the beginning of the campaign, and their strength at the end of the campaign on 25 August 1944: 74 tanks in late August vs. over 1,533 at the beginning of the campaign. Furthermore, the chart below does not consider other small units or reinforcements after 1 June 1944. The usual estimates suggest that the Germans lost about 2,500 major AFVs (tanks, tank destroyers, sp artillery) plus over 1,500 light AFVs (armored cars, personnel carriers, command vehicles). Figures for total Allied losses have never been tallied, but were probably higher. The difference was that the Allies could easily sustain the materiel losses, the Germans could not. As late as 10 December 1944, these same panzer units had only been filled out to about half their June 1944 strength, only 824 tanks and StuGs.

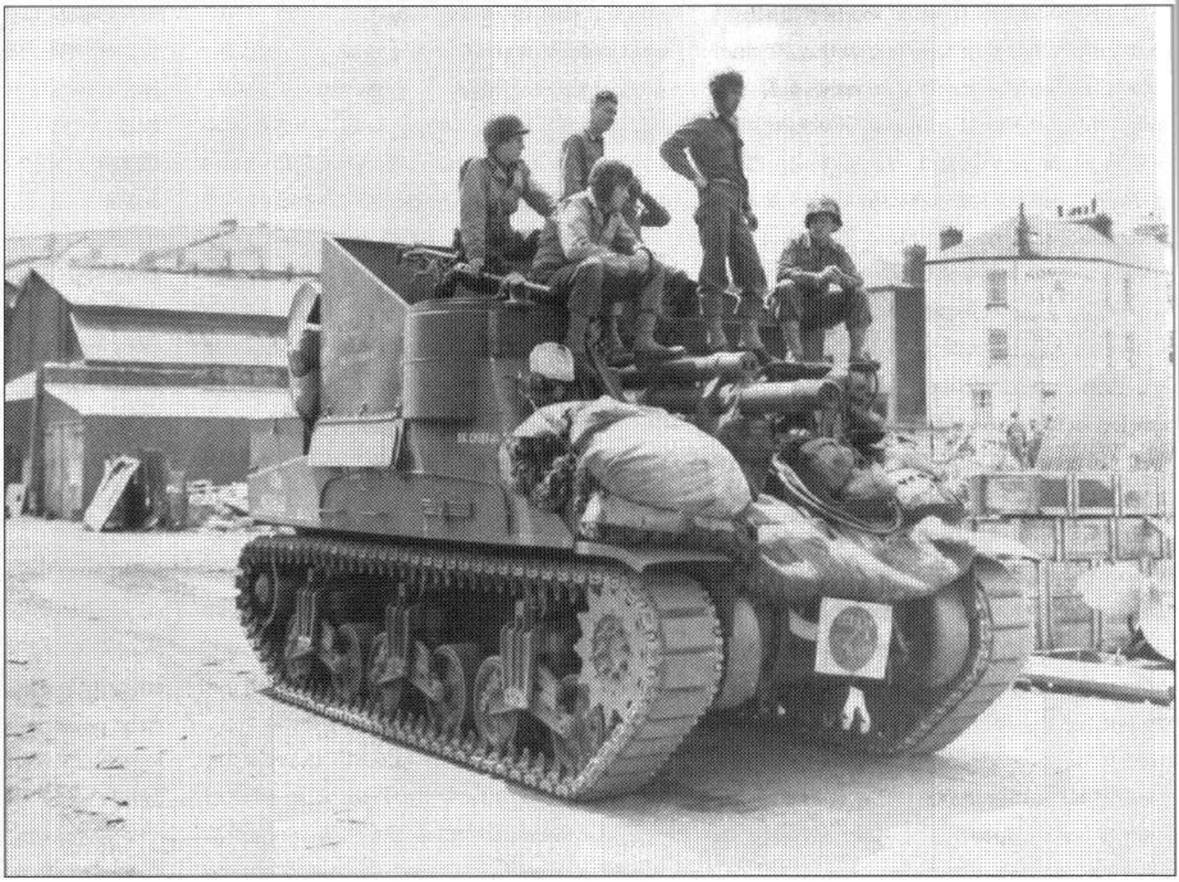
German Operational AFV Strength in France: 1 June vs. 25 August 1944

	Panther	Pz. IV	Tiger	StuG/JagdPz.	Total June 1	Total Aug. 25
2. Pz. Div.	67	94	0	41	**202**	**0**
Pz.Rgt. 33	39	70	0	0	**109**	**0**
21.Pz.Div.	0	121*	0	98	**219**	**12**
116.Pz.Div.	0	84	0	6	**90**	**12**
Pz.Lehr Div.	86	97	6	40	**229**	**0**
s.Pz.Abt. 503	0	0	45	0	**45**	**0**
s.Pz.Jg. Abt. 654	0	0	0	12	**12**	**0**
1.SS-Pz.Div.	38	42	0	44	**124**	**0**
2.SS-Pz.Div.	25	44	0	33	**102**	**15**
9.SS-Pz.Div.	30	41	0	38	**109**	**25**
10.SS-Pz.Div.	0	32	0	34	**66**	**0**
12.SS-Pz.Div.	48	91	0	10	**149**	**10**
SS-Pz.Abt. 17	0	3	0	37	**40**	**0**
s.SS-Pz.Abt. 101	0	0	37	0	**37**	**0**
Total	*333*	*719*	*88*	*393*	**1533**	**74**

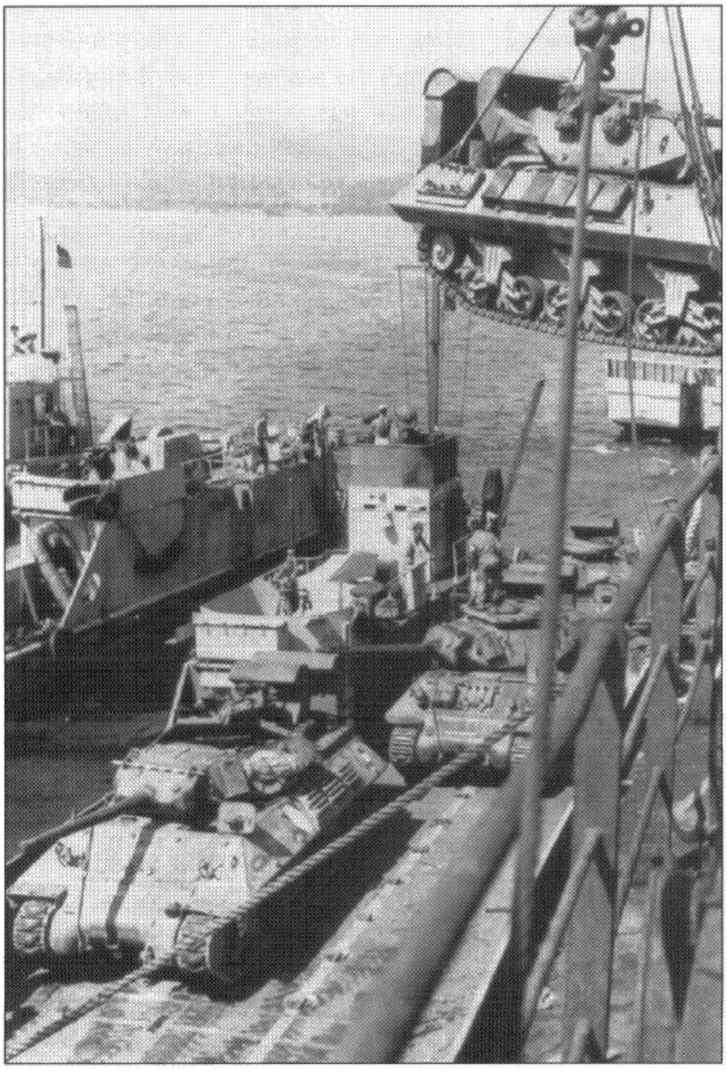
(*includes 6 Pz.Kpfw. III and 23 SOMUA 35.S tanks)

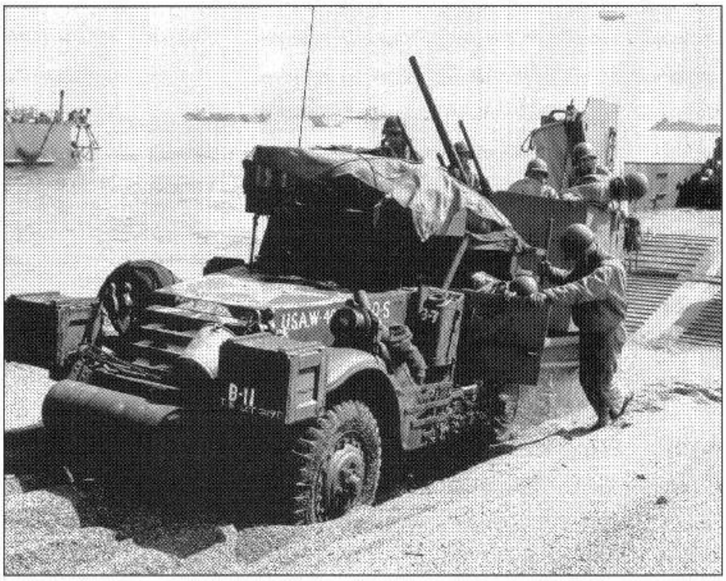
While some units were left behind to clear out the pocket, Patton's Third Army, spearheaded by the 4th Armored Division, exploited the German collapse and raced westward over the Seine, reaching Troyes by 25 August. Gen. Philippe LeClerc's French 2nd Armored Division, the best of the Free French units, was authorized to move into Paris in the third week of August, marking the near total collapse of German resistance in northwestern France.

D-Day Landings



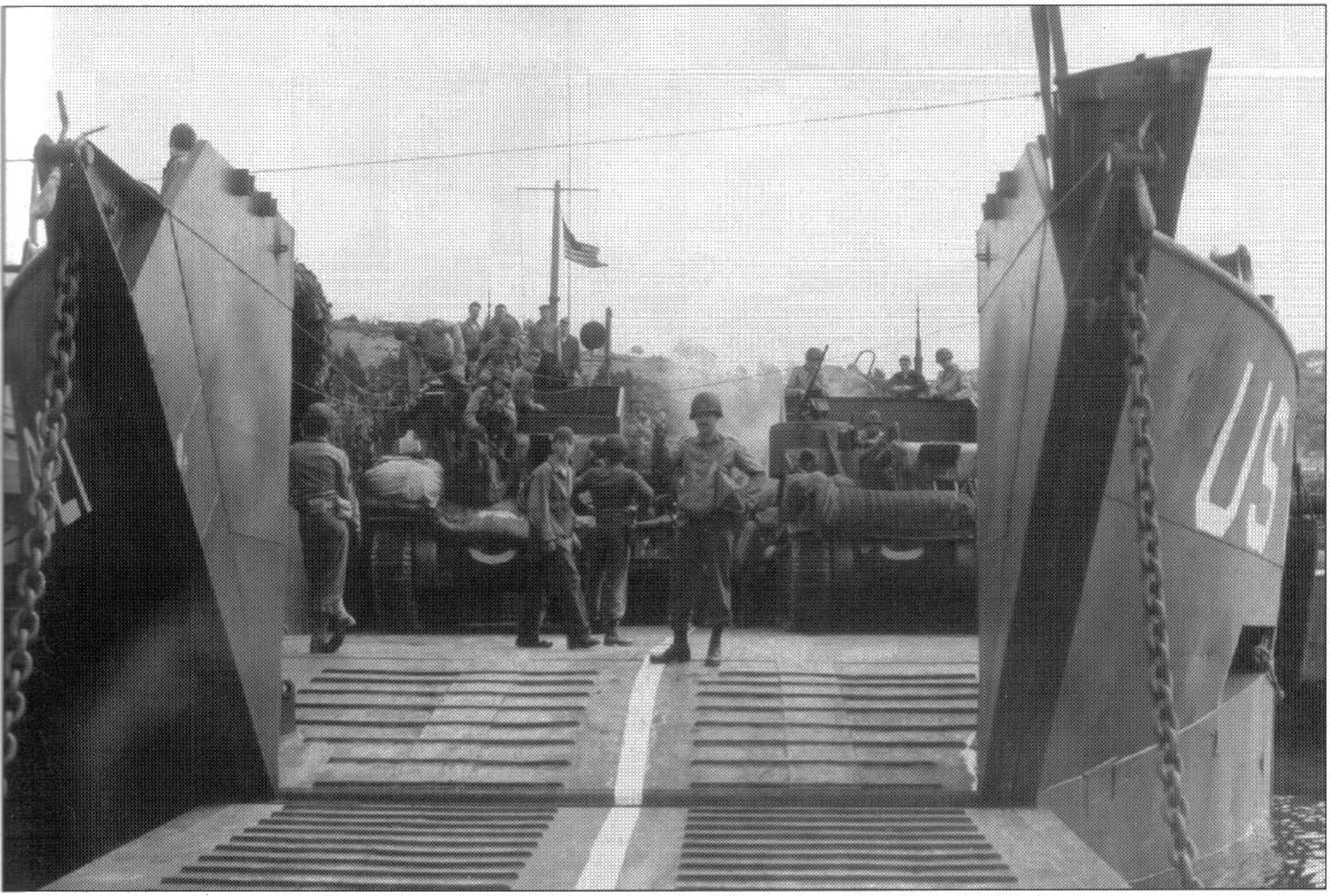
Months of preparation went into the Normandy landings. Here, an M7 105mm HMC of Battery B, 42nd Field Artillery sits at dockside in Portsmouth, England on 1 June 1944 prior to the invasion. This is an early production vehicle, with the older style M3 medium tank suspension. This M7 has been prepared for landing by the addition of deep wading trunks at the rear, and a wading combing around the superstructure to prevent sea water from flooding the vehicle during landing. (US Army)



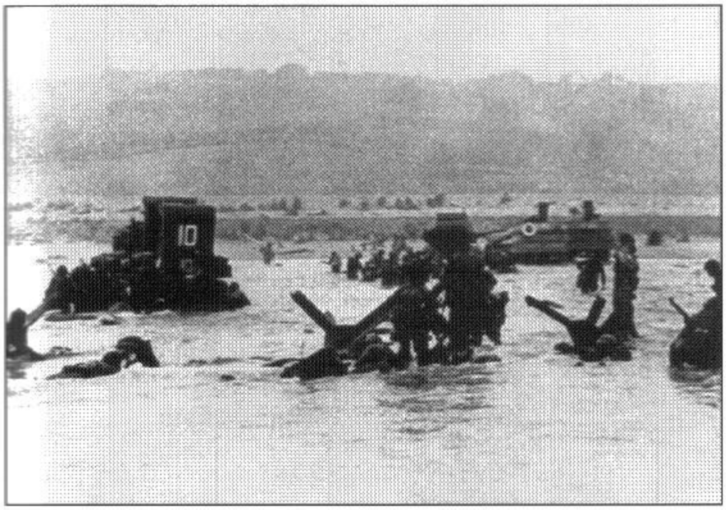


A M15A1 CGMC anti-aircraft vehicle is stuck in the soft beach sand at Slapton Sands on the English coast on 27 April 1944 during invasion exercises. The Slapton Sands exercise area was the scene of a controversial incident prior to the invasion when German E-boats managed to sink a troop-laden cargo ship, leading to heavy losses amongst the US infantry on-board. The incident was officially censored in 1944 for fear of revealing information about the forthcoming invasion, and became the source of controversy in the 1980s when relatives of the infantrymen lost in the incident tried to learn more details of the disaster. (US Army)

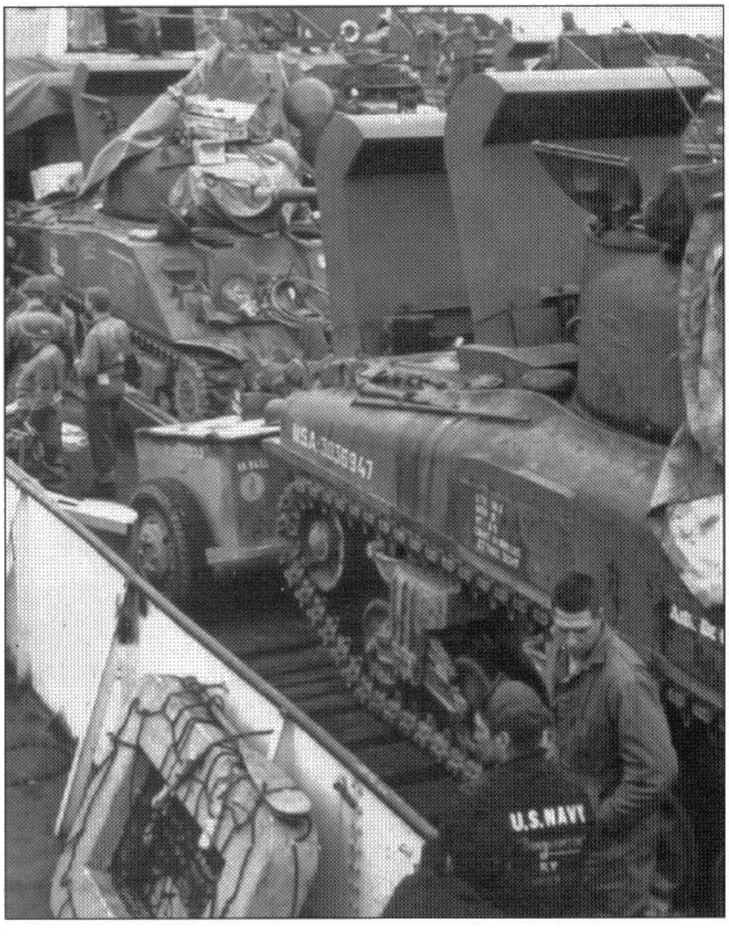
Four M10 3 inch tank destroyers are loaded aboard an LCT Mark 6, probably in Weymouth or Torquay harbor, in early June 1944. Each LCT could carry four medium tanks or their equivalents. These were the most common landing craft used in the initial assaults, with follow up landings conducted with the larger LSTs. Many of the LCTs delivering US tank units to the beaches on D-Day were manned by Royal Navy crews. (US Army)



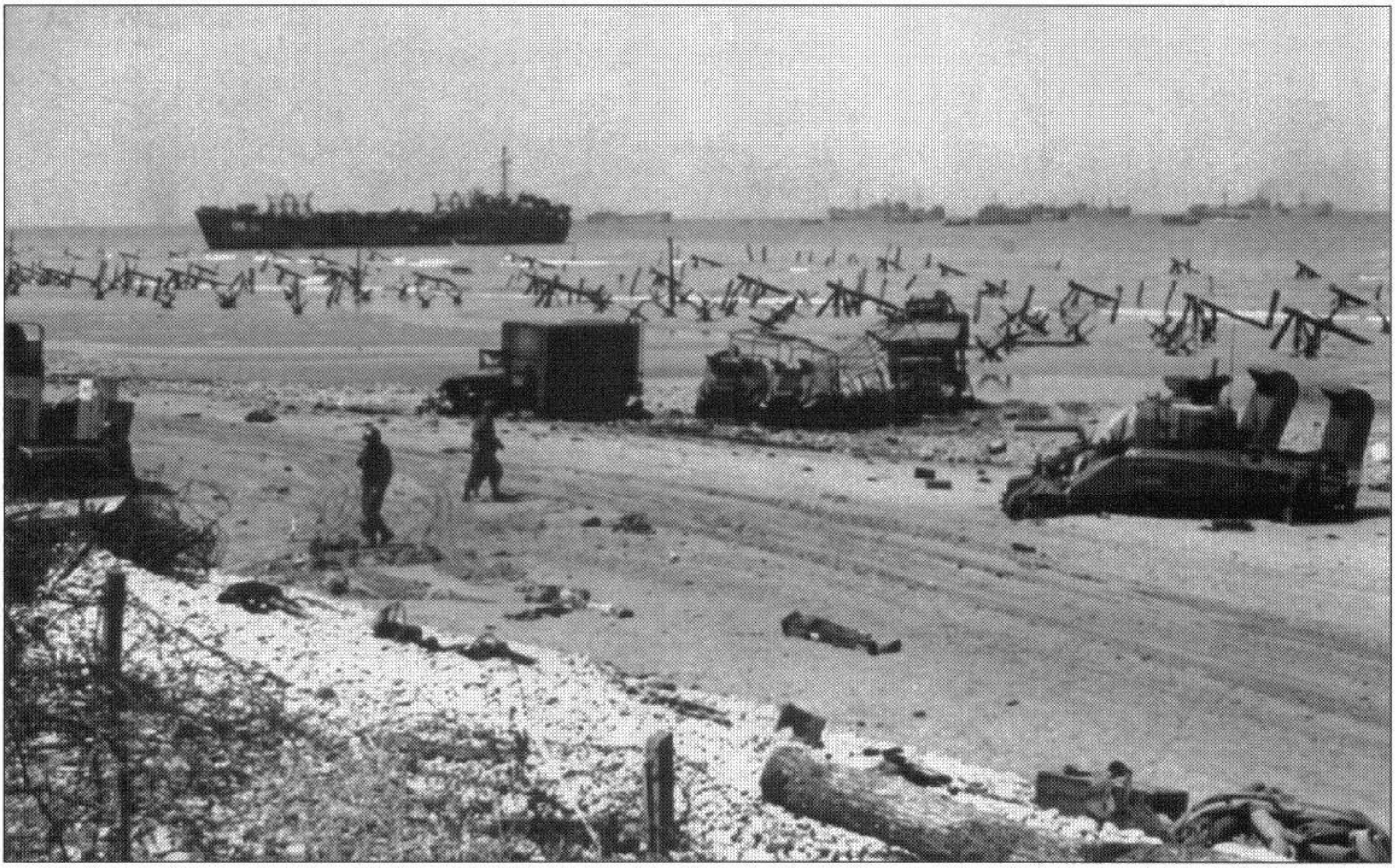
A captain directs-in another M7 105mm HMC on an LCT in Britain prior to the D-Day landings. The M7s are fitted for deep wading, and both have large camouflage nets rolled up and stowed on their bows. (USS Intrepid Museum)



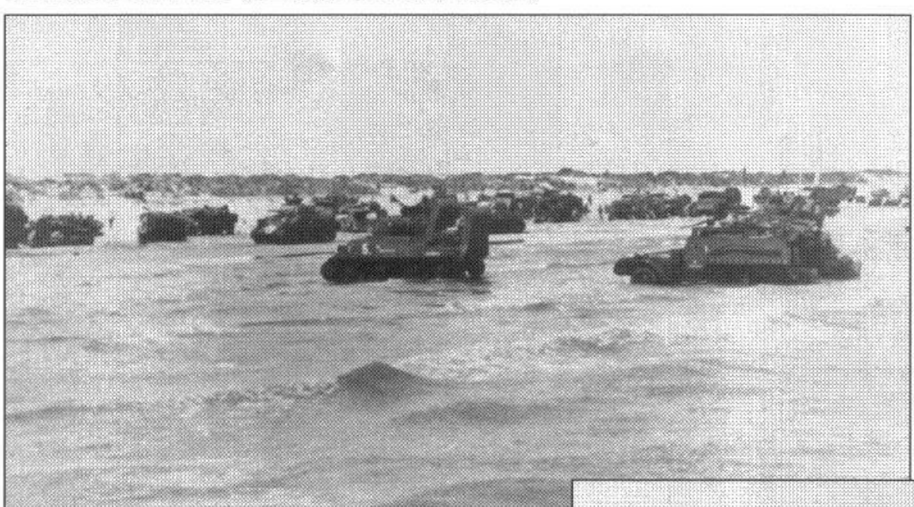
Few photos survive of the Omaha beach landings. Here is a rare shot from the morning of 6 June at Omaha beach with a M4 with deep wading trunks to the left and a M4 Duplex Drive to the right from the 741st or 743rd Tank Bn. The high escarpment that trapped the US forces on Omaha is very evident in this view. Many of the 96 tanks landed at Omaha beach were knocked out by German anti-tank guns placed in bunkers along the beach or along the escarpment. (The Tank Museum)



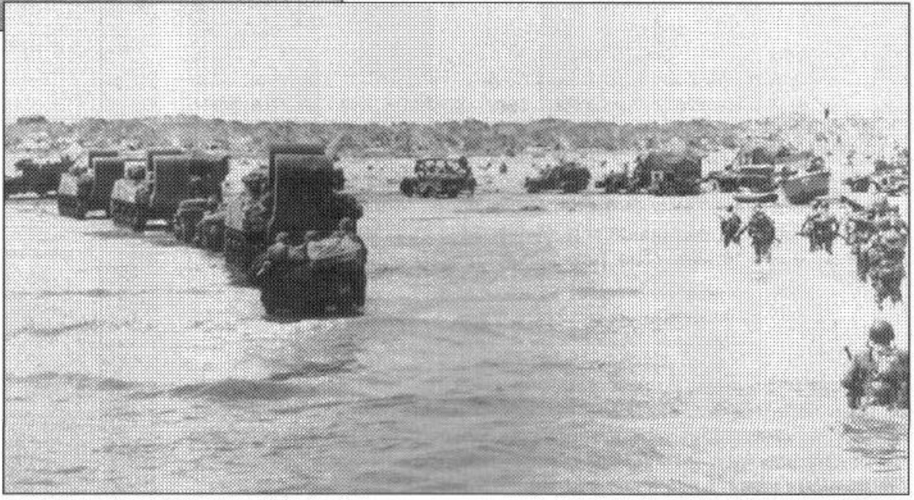
A pair of M4 medium tanks of A Company, 741st Tank Battalion on their LCTs in harbor in Britain prior to embarking to France for the landing at Normandy. These tanks were part of the first wave of four LCTs that landed on Omaha beach on D-Day. Most of the tanks were quickly knocked out by German gun emplacements. (US Army)



The difficulty and cost of landing at Omaha is highlighted by this photo taken after the landings, probably on D+1. The beach is littered with bodies and debris, including a bogged down M4 medium tank to the right, probably one of those from 741st Tank Bn. The approach to the beach is littered with steel obstructions and mines. (US Navy via Intrepid Museum)

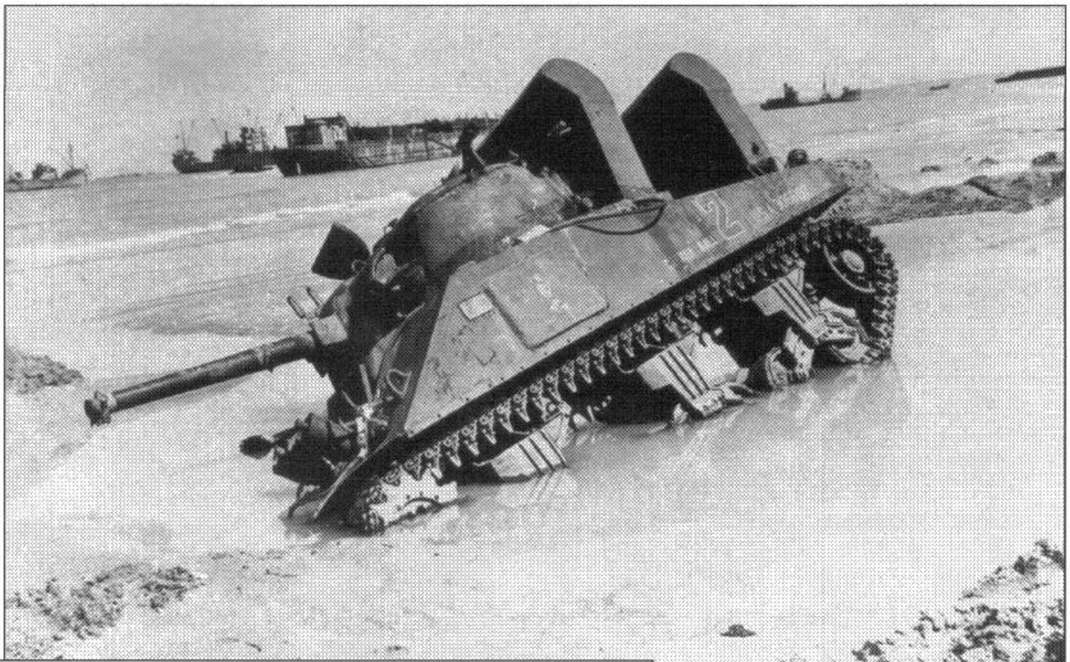


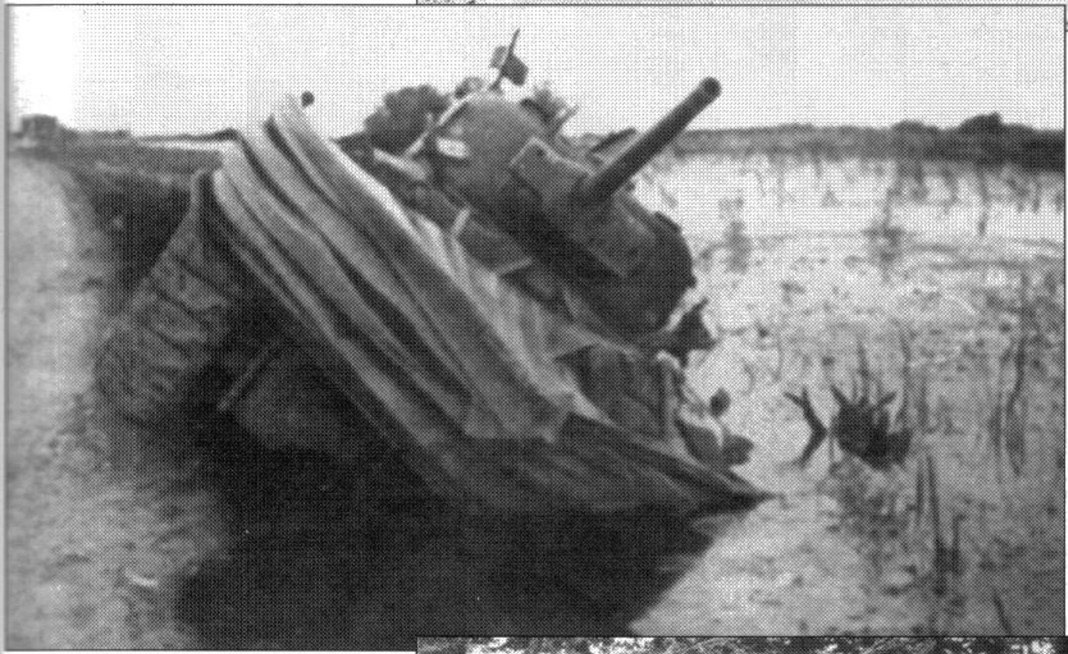
The situation at Utah beach was not as desperate as at Omaha. Here, Company C of the 70th Tank Bn. lands with their M4s, fitted with deep wading trunks. In contrast to Omaha beach, notice the lack of a high escarpment beyond the beach, a geographic detail which greatly effected the course of the fighting. (US Army)



Another view of the landing at Utah beach, with additional M4 medium tanks driving ashore with the deep wading trunks fitted. The 746th Tank Battalion landing at Utah was equipped with three companies of M4 medium tanks with deep wading trunks, while the 70th had two companies with Duplex Drive and one with deep wading trunks. (US Army)

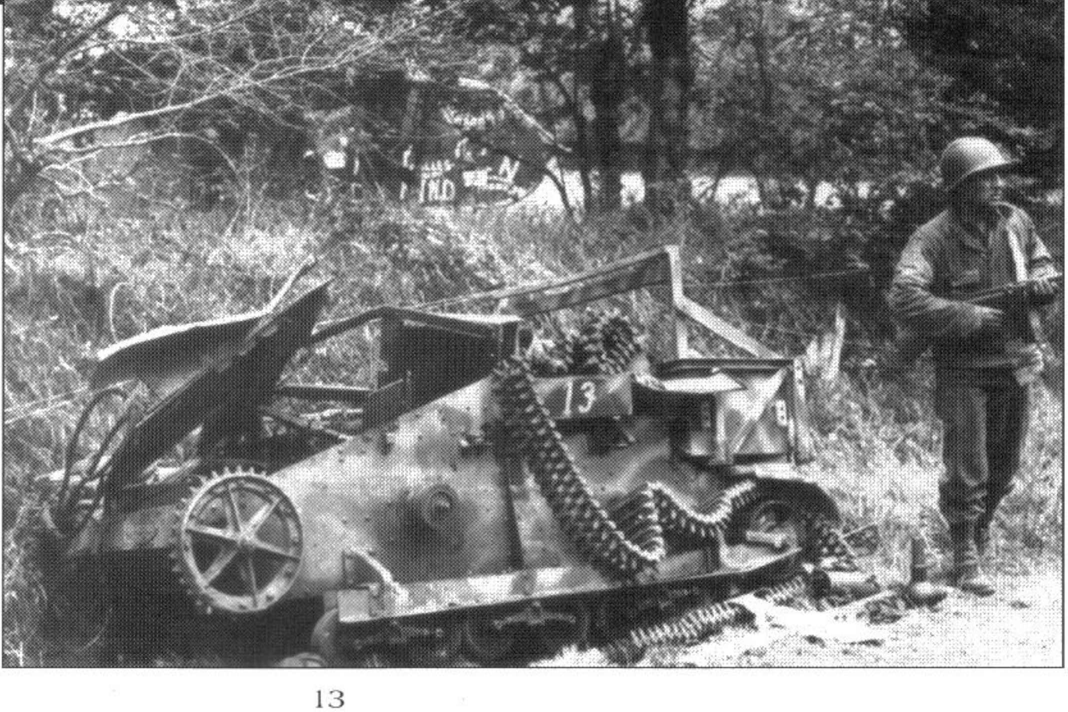
One of the few detailed photos to have survived of a US tank from D-Day is this view of "Cannonball", a M4 medium tank with deep wading trunks of Company C, 70th Tank Bn. that became trapped in a tidal pool at Utah beach during the landing. The large red numbers with white trim were a characteristic marking of this unit. (US Navy)

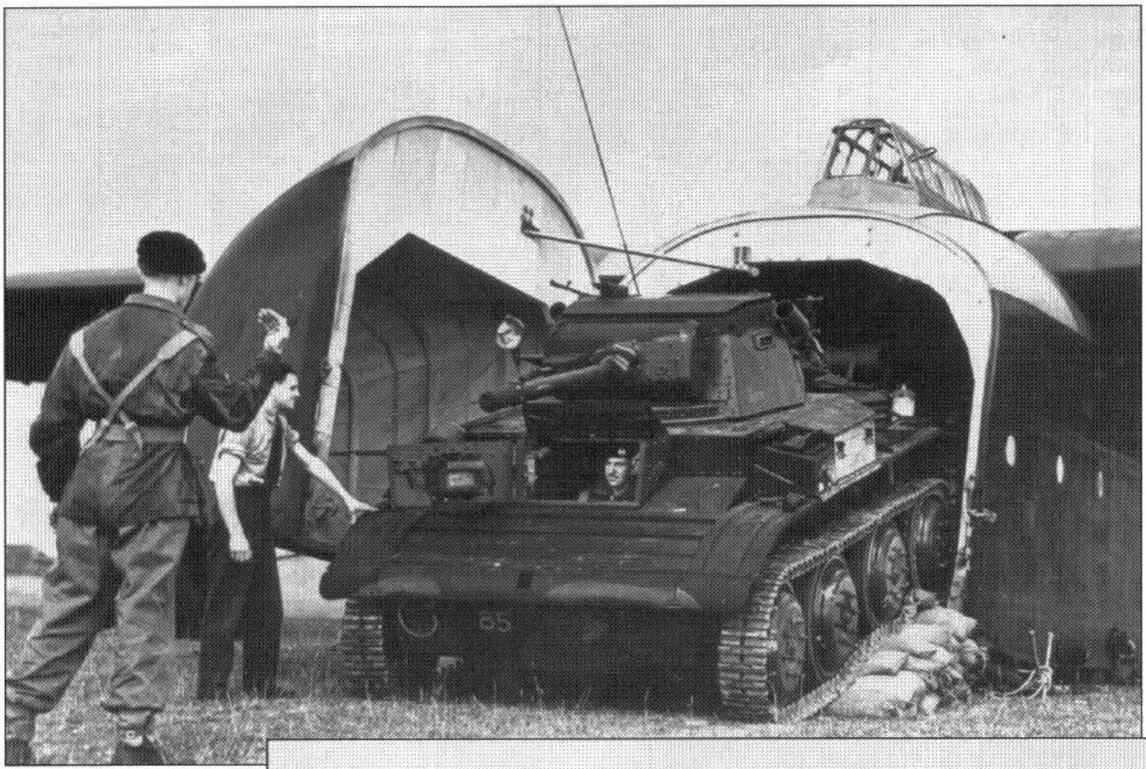




Although of poor quality, this rare photo shows one of the M4 Duplex Drive tanks that landed with the US Army on D-Day. This is a tank from the 70th Tank Bn. that was part of a detachment of three tanks sent to secure the Exit 2 causeway past the tidal swamps that separated the main landing beach at Utah from the mainland. The first tank in the group struck a mine and was disabled, while this tank was hit by a concealed German anti-tank gun that was finally silenced by the third tank in the column. This tank was pushed off the causeway to make room for the troops who followed.

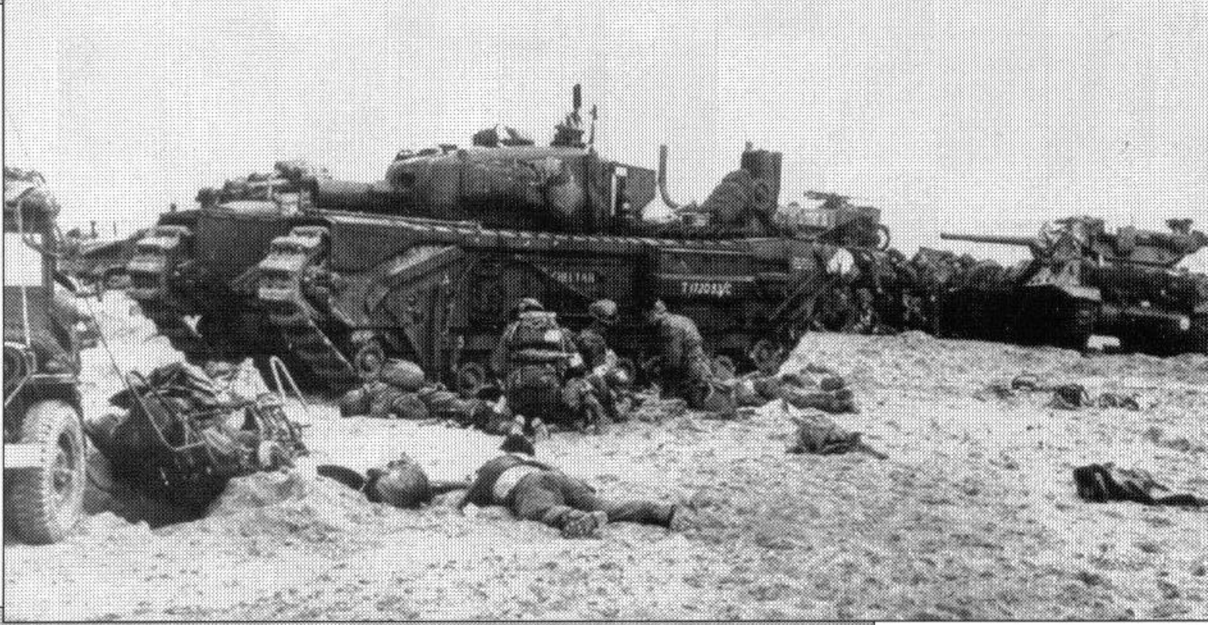
During the night landings that preceded the D-Day amphibious assault, the 82nd and 101st Airborne landed immediately behind the beaches. They encountered a few German armored vehicles, including this Renault UE armored tractor. The UE was built for the French Army to tow anti-tank guns, and was used in the same role by the Wehrmacht when many were captured in 1940. Evident in the background is a Waco CG-4 glider that landed some of the US troops.

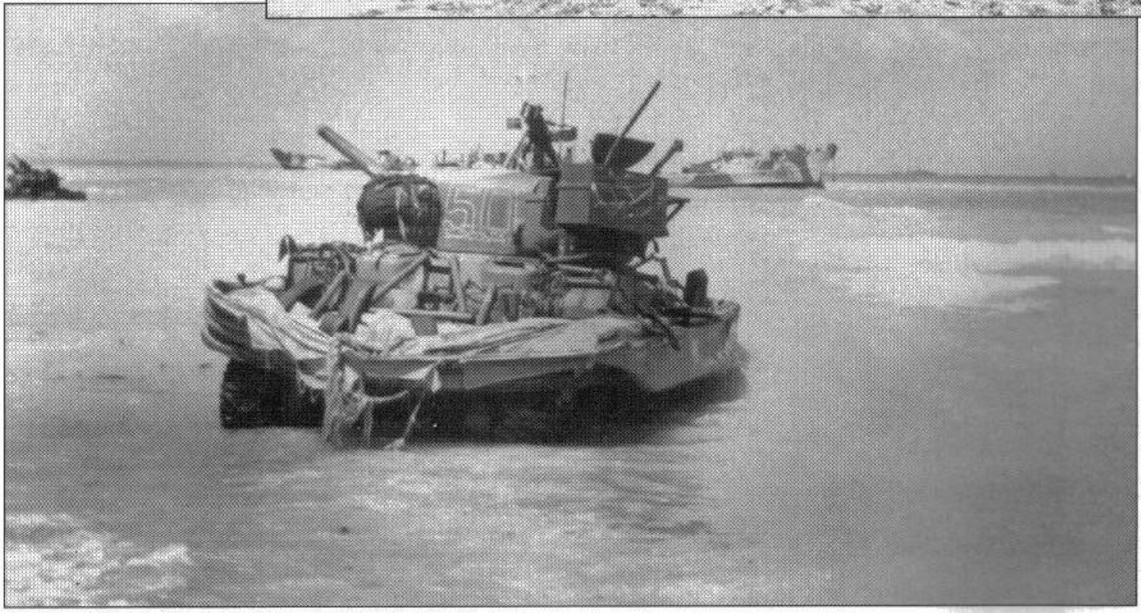




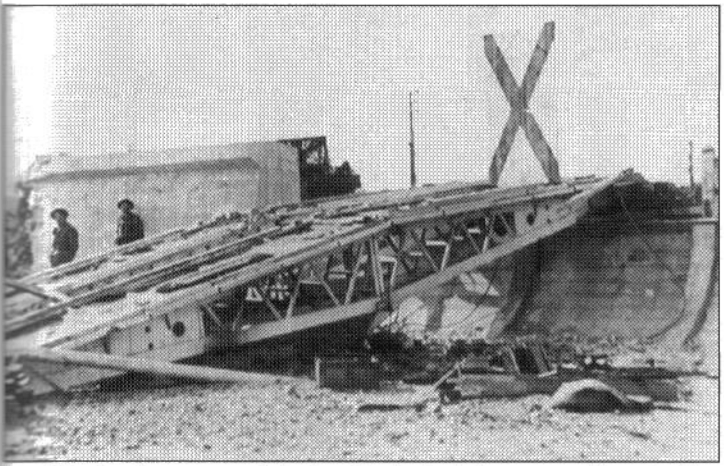
One of the most curious tanks taking part during D-Day were the eight Tetrarch light airborne tanks of the British 6th Airborne Recce Regt., 6th Airborne Division which landed in the second wave on the evening of D-Day on Hamilcar gliders to help the paratroopers seize the Orne river crossings. This is "Ritz", a Tetrarch Mk. 1CS of the HQ section, which was armed with a 3 inch gun for close support instead of the usual 2 pdr. This photo was taken during training prior to the landings. The Tetrarchs were not very effective during the operation, as their suspensions tended to become ensnared by the tough nylon parachute suspension lines that littered the landing zone. They were later replaced with Cromwell tanks. (The Tank Museum)

A Churchill IV AVRE named "Cheetah" of the 79th Armoured Division provides shelter for troops of the 2nd East Yorkshire on Sword Beach during a German artillery bombardment on D-Day. In the background are a pair of M10 Achilles Mk. II. Known as "Hobart's Funnies", the 79th Armoured Division provided much of the specialized armor used by British forces on D-Day to assist in the landing. (The Tank Museum)

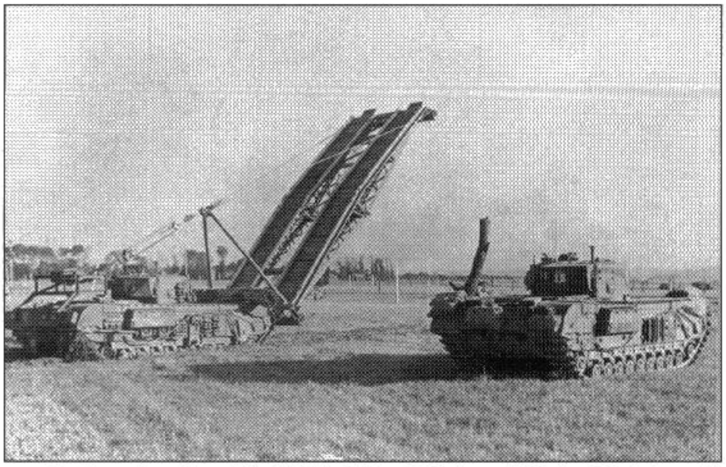




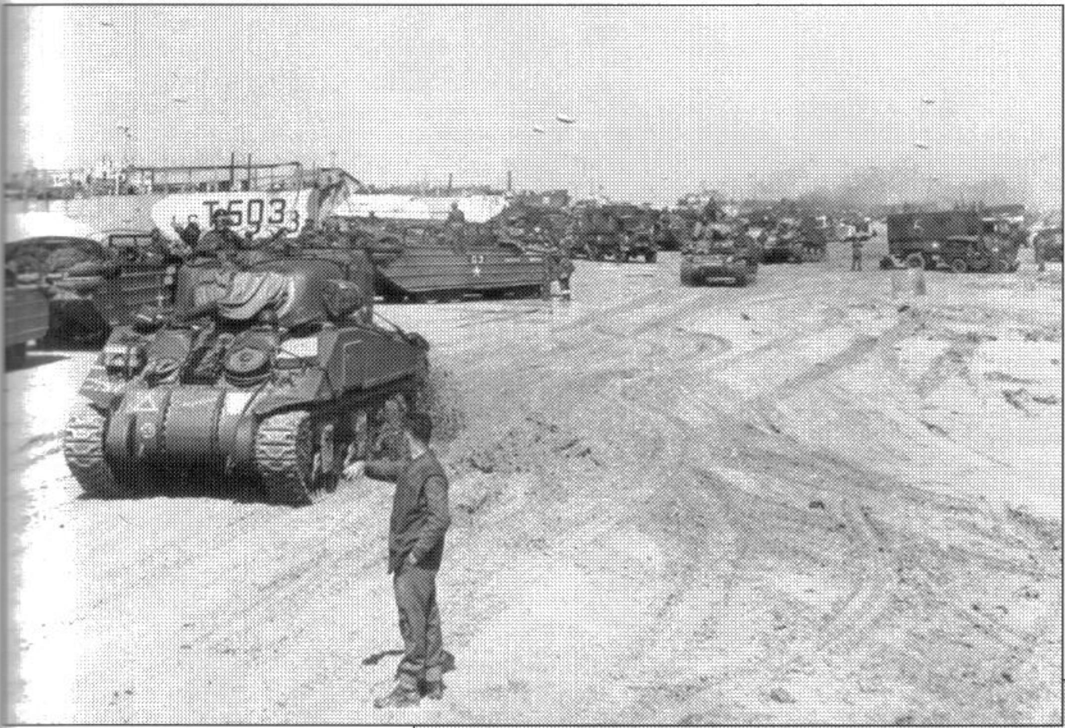
This Sherman II Duplex Drive of the 13/18th Hussars almost made it all the way to shore on D-Day, but got stopped short at Sword Beach The Duplex Drive consisted of a canvas skirt around the tank which made it bouyant combined with a pair of propellors at the rear for propulsion. In this view, the screens are collapsed, showing the rubber inner tubes that helped keep the swimming skirt erect. This tank is marked with a large white Allied star on the turret roof, and large, two-digit tactical numbers on the turret side. (The Tank Museum)



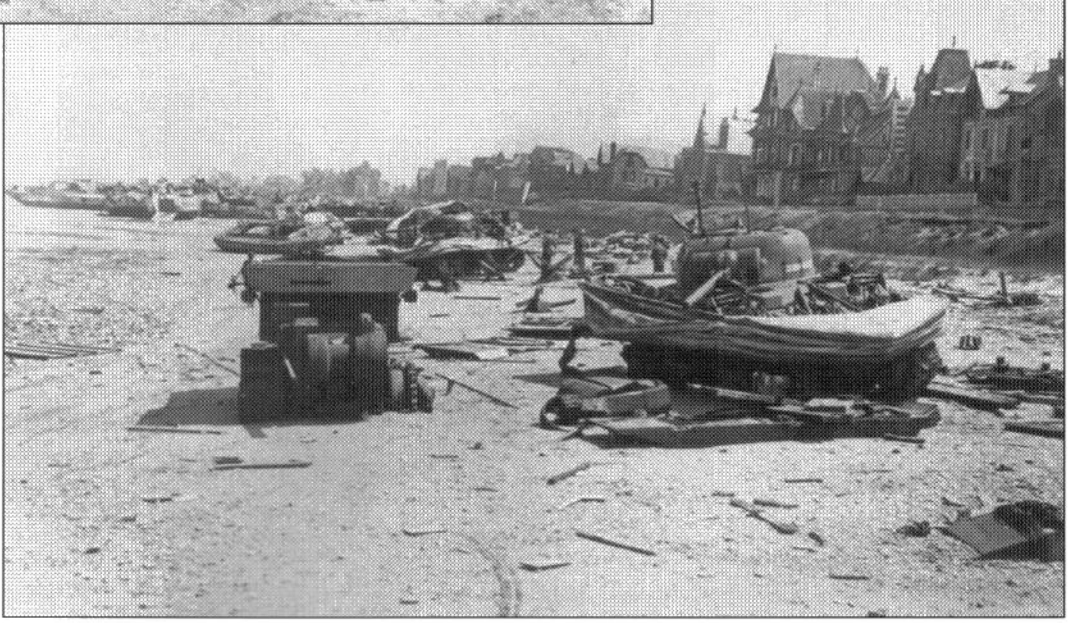
The beach area was full of anti-tank obstacles, sea walls and other obstructions which threatened to hold up the advance. The Churchill AVREs of the 79th Armoured Division could carry a variety of anti-obstacle devices on the front, including the SBG (Small Box Girder) seen here after being dropped at one of the beaches' sea walls on D-Day. (The Tank Museum)



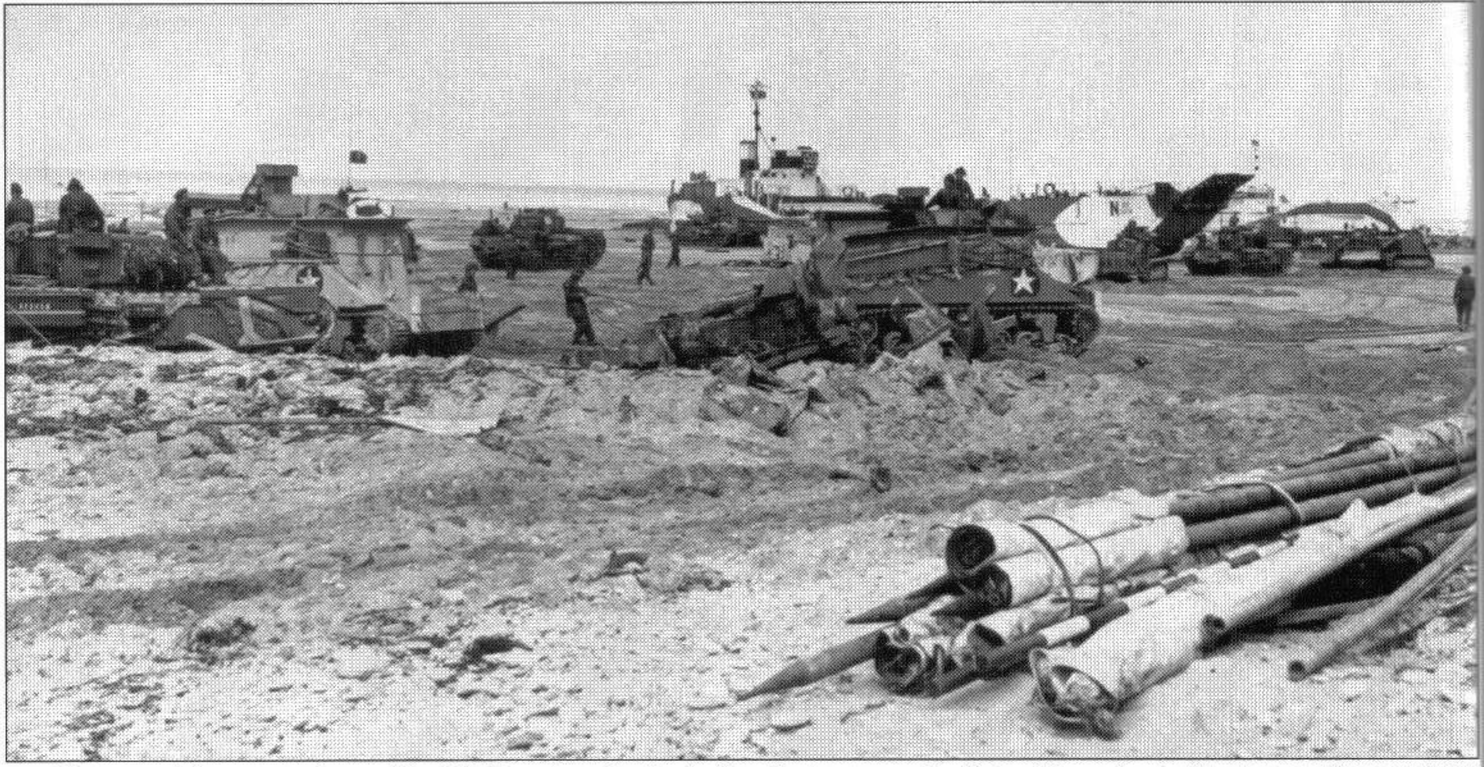
A view of a Churchill AVRE of the 222 Assault Sqd., 42nd Assault Regt., 79th Arm'd Division with the SBG fitted at the front. The SBG was designed to cover anti-tank ditches or other beach obstructions; a small roll of fascines was carried at the front of the tank that was dropped at the lip of the SBG to help tanks mount it. This photo was taken in September 1944 when the Funnies were supporting operations near Le Havre. (The Tank Museum)



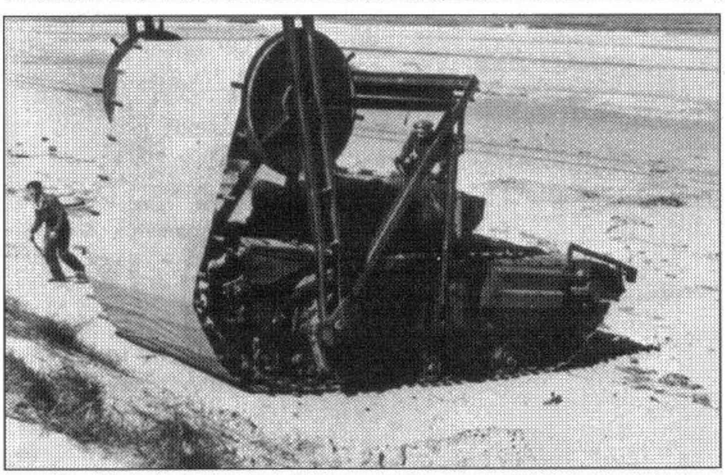
A column of Shermans of A Squadron, 24th Lancers moves off Gold Beach on D-Day with many DUKWs in the background. The 24th Lancers were part of the 8th Arm'd Bde., which provided tank support to the 50 Div Group at Gold Beach. The lead vehicle here, named *Armageddon*, has had part of its wading trunks removed but still retains the canvas waterproofing over the main gun. Units markings evident on the front of the tank include the triangle (indicating A Squadron) with a yellow bridging circle below, the tank name on the center of the transmission housing, and the brigade insignia above the right stub fender. (The Tank Museum)



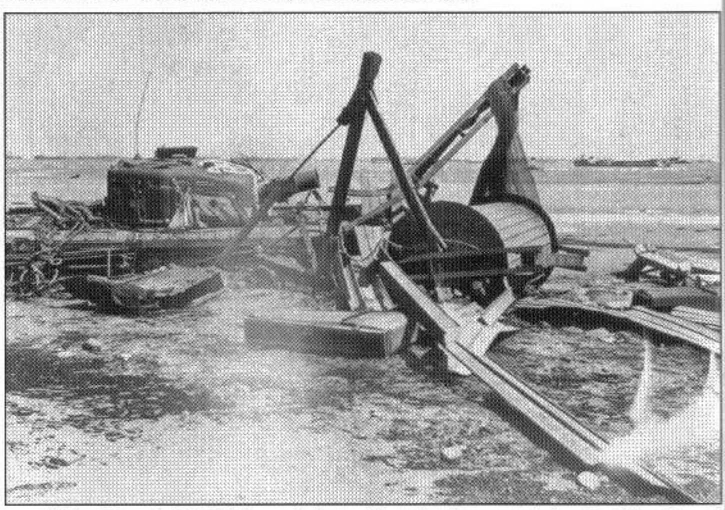
The debris of war still litters Sword Beach near the village of Lion-sur-Mer. In the foreground is a disabled Sherman Duplex Drive, presumably from 13/18th Hussars, and an armored bulldozer. The Duplex Drive Shermans were generally successful in swimming ashore except at Omaha Beach, where the strong wave conditions swamped most of the DD tanks of the 741st Tank Bn. (The Tank Museum)



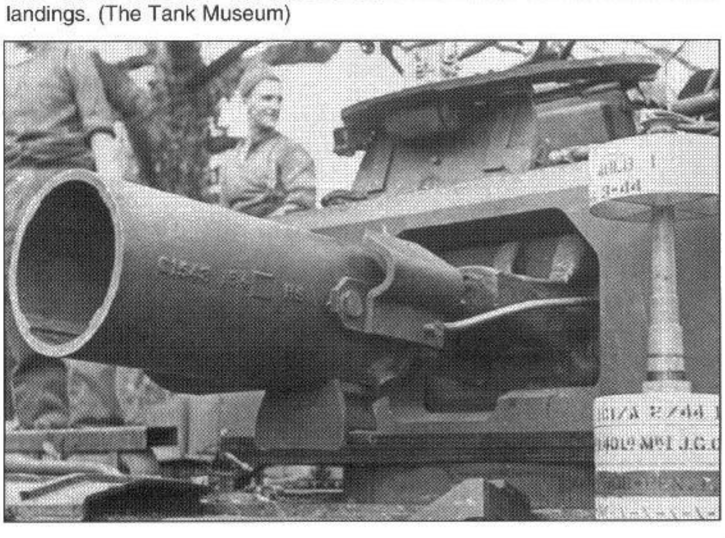
Clean-up activity goes on at one of the British beaches after the landing. The two armored vehicles with prominent white stars are Sherman BARV (Beach Armoured Recovery Vehicles), an interesting British innovation based on the M4 medium tank chassis. A large watertight superstructure was built on the chassis, which allowed the vehicle to operate in the surf to recover disabled tanks and other vehicles. (The Tank Museum)



The Normandy beaches had several areas of blue clay which were difficult to negotiate with tanks. As a result, some of the Churchill AVREs of the 79th Armoured Division were fitted with these Bobbin devices on the front which laid a carpet of reinforced canvas to create a passable surface. This shows a Bobbin equipped Churchill AVRE on exercise before the landings. (The Tank Museum)

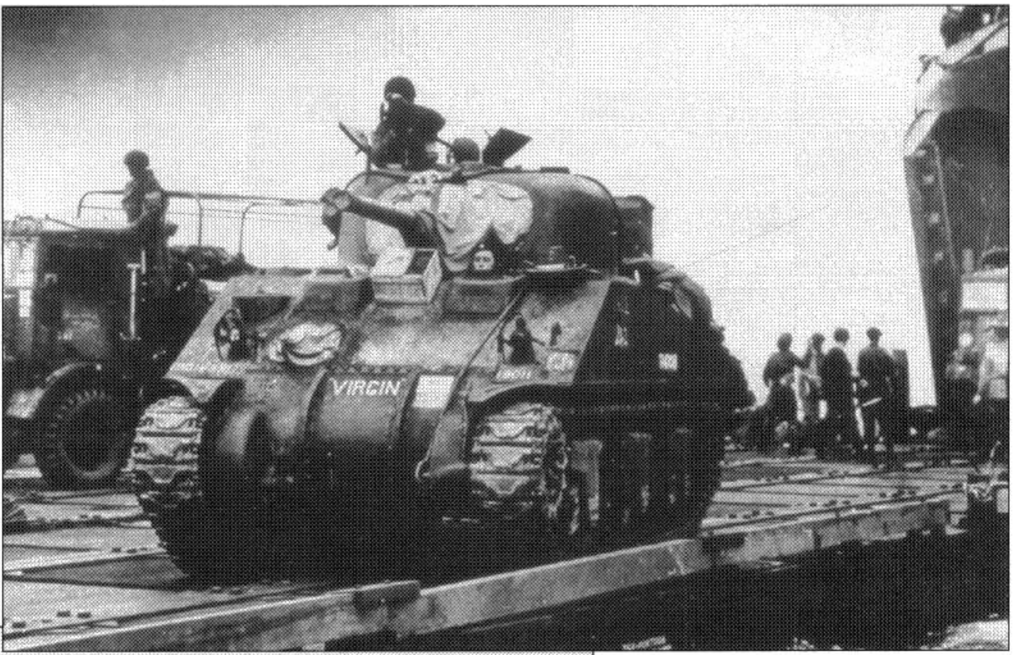


This Churchill AVRE tank has already dispensed its Bobbin Mk. 1 matting, with only the core and framing sitting in a jumble aside it following the landings. These elaborate devices were prompted by the disaster that befell the Canadian Churchills at Dieppe in 1942 when the tanks floundered due to shingle on the beach. (The Tank Museum)

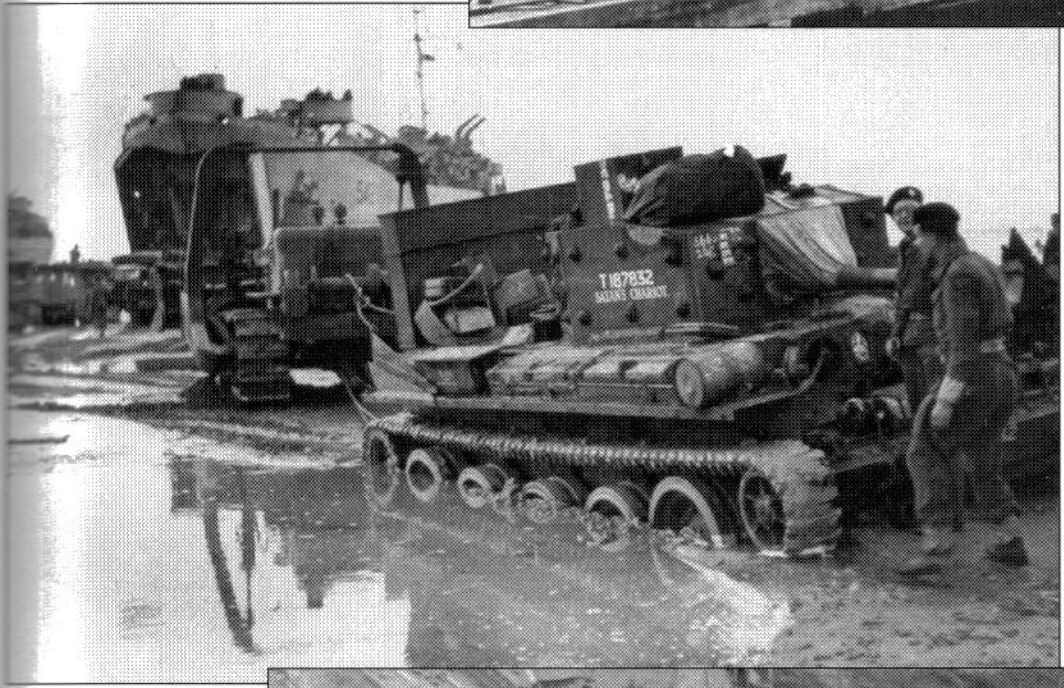


One of the most efficient weapons employed by the Churchill AVREs at Normandy was the Petard mortar, a type of spigot mortar which fired the large "Dustbin" projectile seen here near the mortar. This weapon was designed specifically to knock out steel-reinforced concrete pillboxes. About 180 Churchill Mk. III and IVs were coverted to AVREs prior to D-Day, mainly serving with the 1st Assault Bde. RE of the 79th Armoured Division. (The Tank Museum)

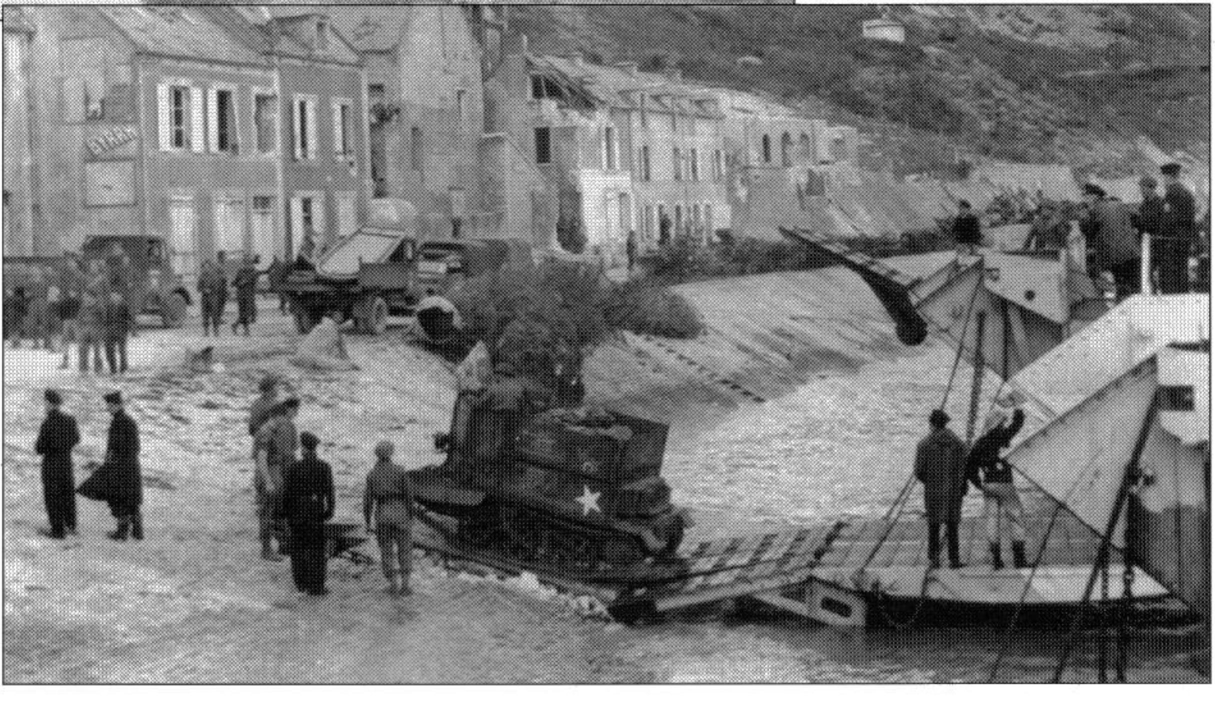
Reinforcing the Beach-Head



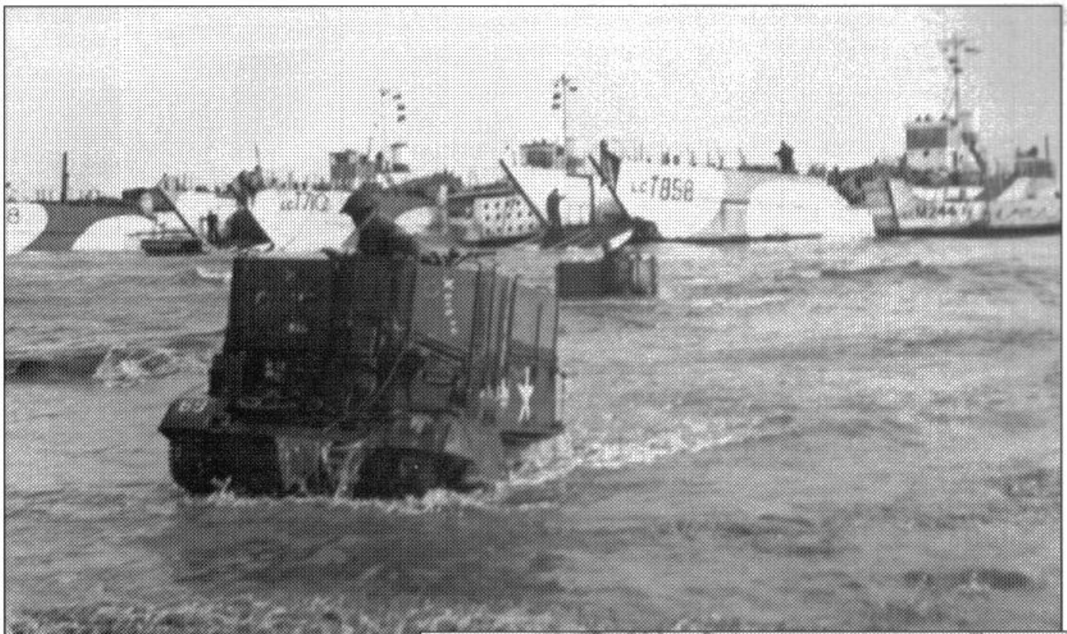
A Sherman V of the 8th Tank Brigade comes ashore via a Rhino several days after D-Day. The Rhinos allowed LSTs to land tanks off-shore without deep wading preparations, and without the need for the ship to negotiate through the obstacle-strewn shallows near the beach area. (US Navy)



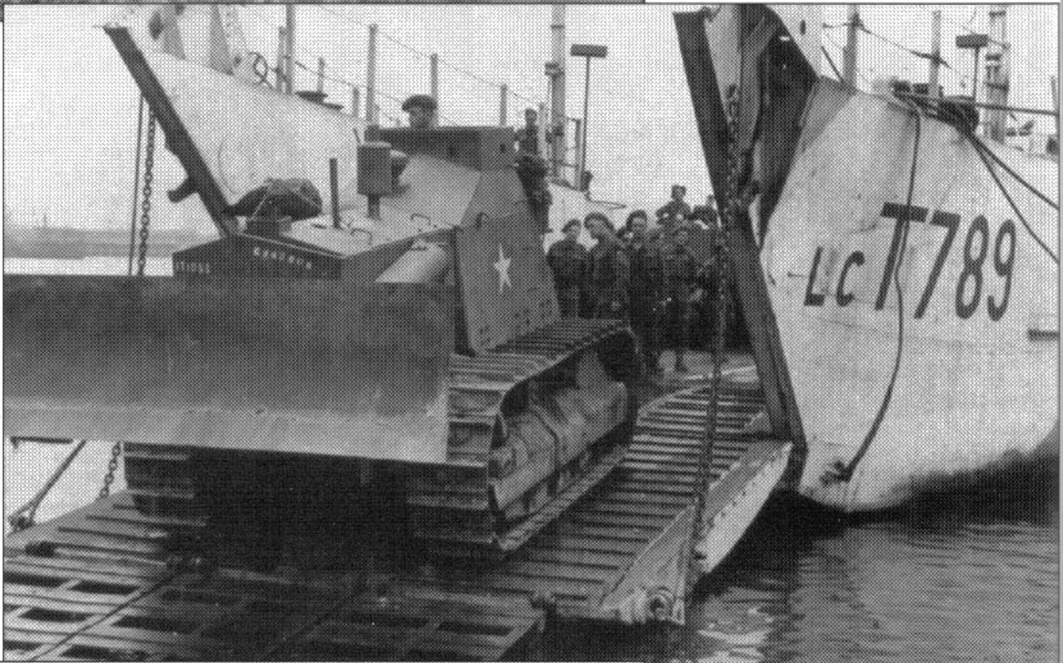
A Cromwell tank named "Satan's Chariot" of the 5 RTR, 7th Armoured Div. bogged down at Gold Beach is recovered by a bulldozer while a LST unloads in the background. This vehicle is fitted with the seldom-seen deep wading trunks used on Cromwells and related cruiser tanks. The 7th Armoured Division was the main armored component of the follow-on forces, landing on 9 June to reinforce the British XXX Corps. (The Tank Museum)



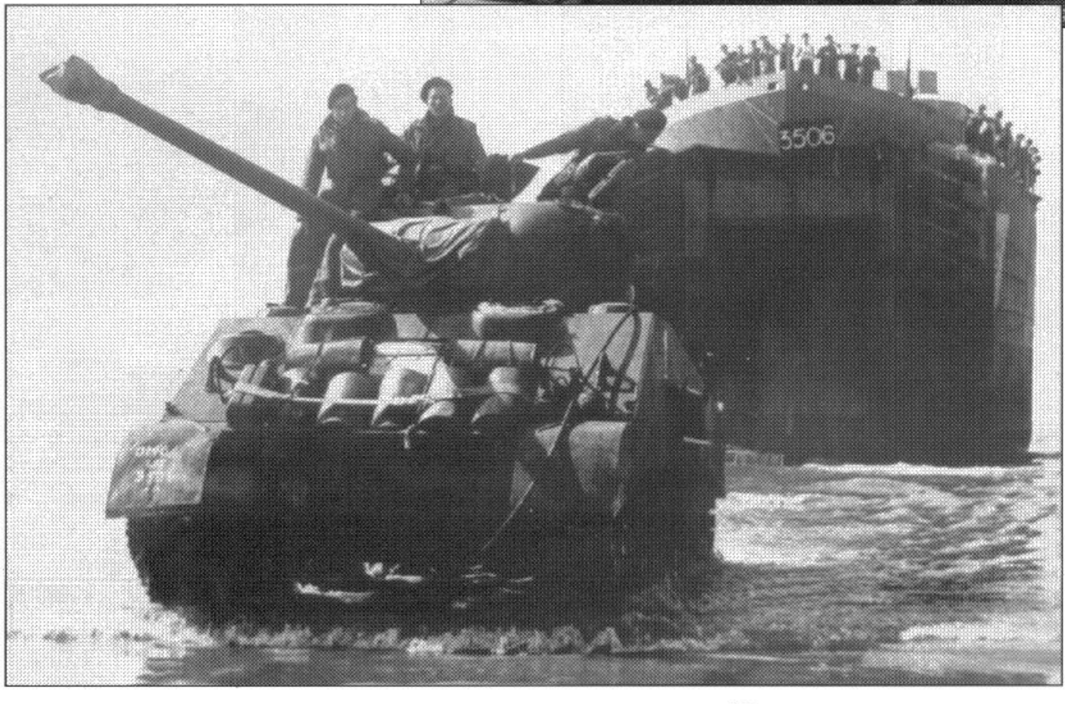
A Deep Wading Universal Carrier comes ashore directly on the beach at high tide from a LCT. Because the Universal Carrier was so low to the ground, a very extensive combing had to be added around the superstructure to allow it to wade in through the surf. The Universal Carrier was the standard infantry vehicle of the British Army in Normandy, but after the July fighting, attempts were made to develop better protected vehicle. (The Tank Museum)



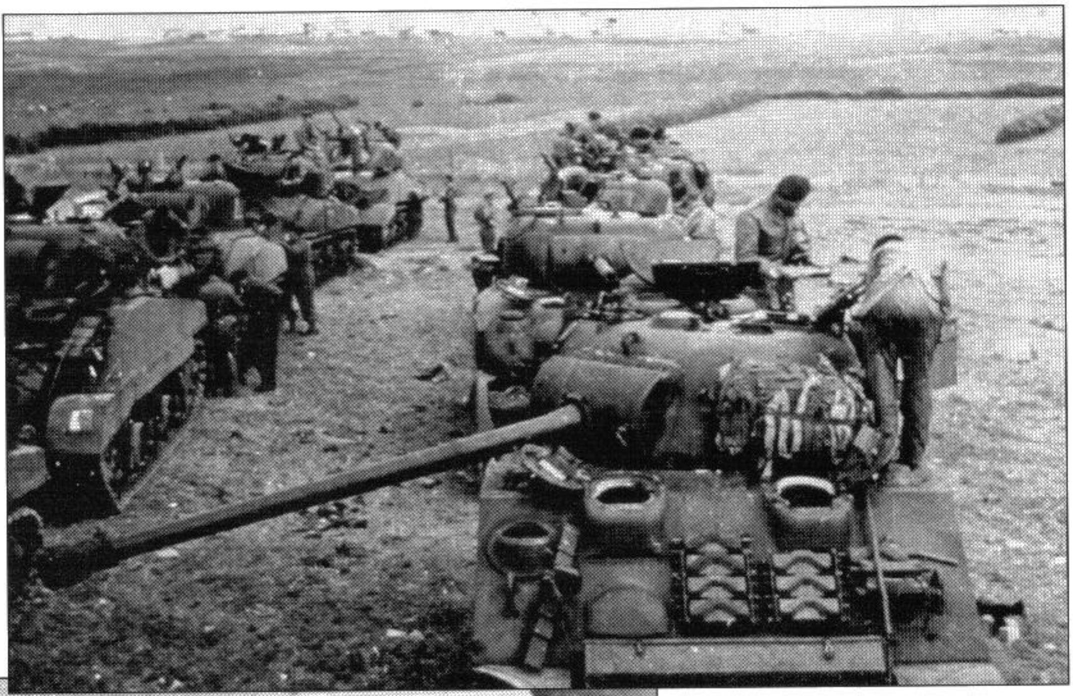
A pair of Universal Carriers of the 50th Northumbrian Division come ashore at Sword Beach from the LCTs behind them. This gives a good idea of why the extensive combing had to be added around the superstructure. (The Tank Museum)



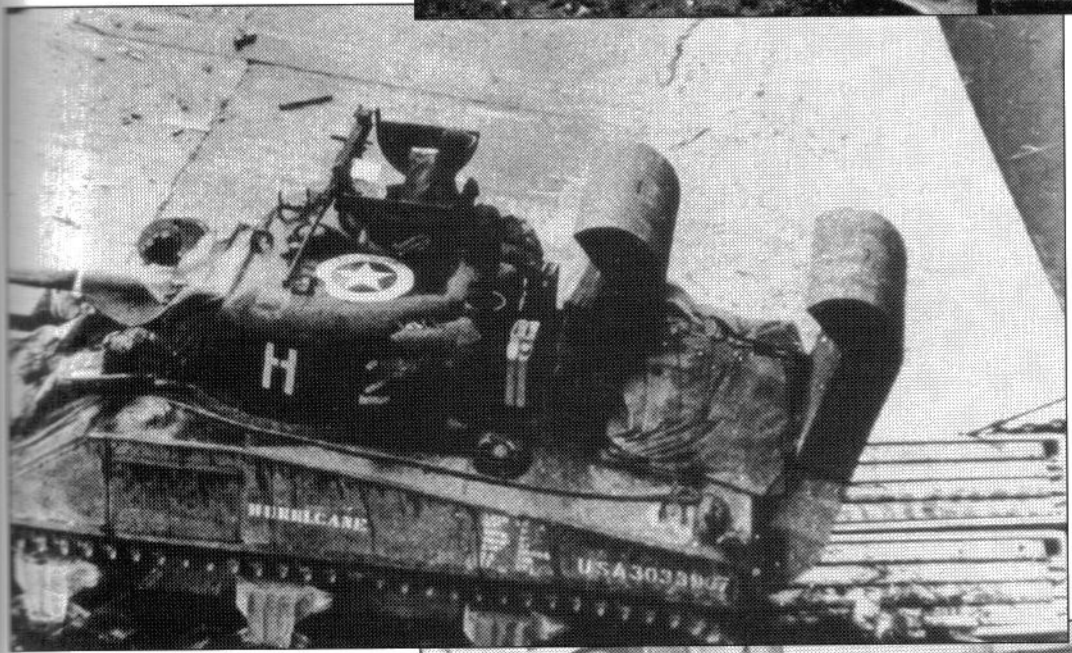
One of the most useful vehicles deployed on the British beaches on D-Day were these armored bulldozers. Although the US Army also used bulldozers on its beaches, it did not armor the cab or radiator like the British examples, making the driver very vulnerable to small arms fire. This simple innovation greatly enhanced the utility of the British bulldozers in removing German beach obstructions during the critical early phase of the landings. (The Tank Museum)



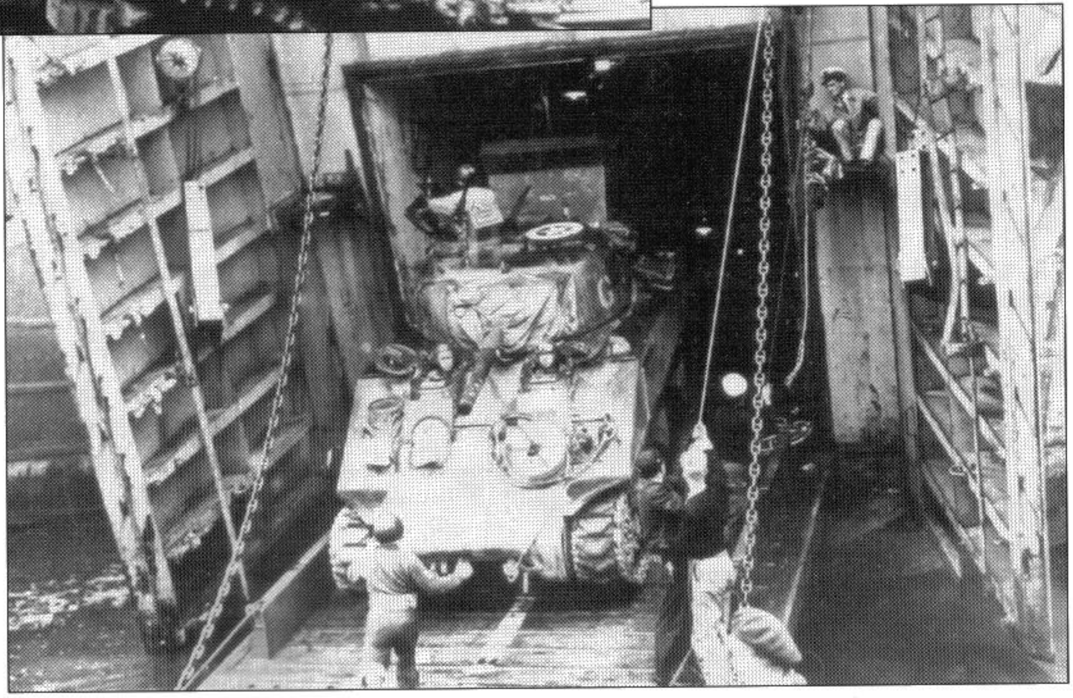
One of the most important innovations in the British armoured divisions was the Sherman Firefly tank, armed with the 17 pdr. This was the only Allied tank able to deal frontally with the heavily armored German tanks like the Panther and Tiger. They were usually issued on a scale of one per troop (one per four tanks) in British, Canadian, and Polish divisions. (The Tank Museum)



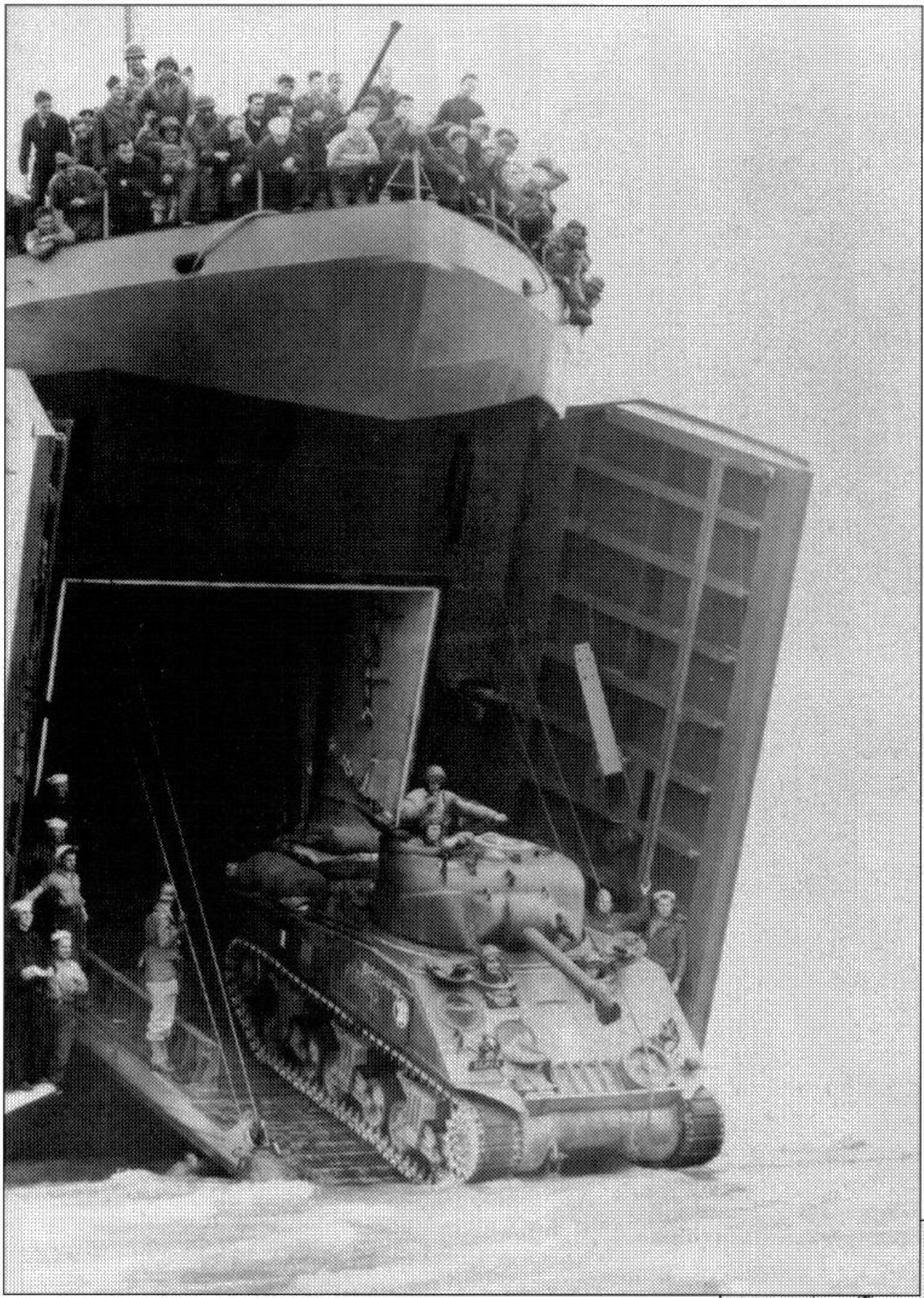
Tankers of the British 4th Armoured Bde., 7th Arm'd Div. prepare their tanks for combat in the fields immediately beyond Gold Beach; the landing area is still evident in the background. The lead vehicle is a Sherman Vc Firefly while the tank behind it is a Sherman II armed with the normal 75mm gun. To accomodate enough ammunition, the Firefly conversion dispensed with the bow machine gun, and careful inspection of the right side of the hull front will reveal that the machine gun position is plated over. (The Tank Museum)



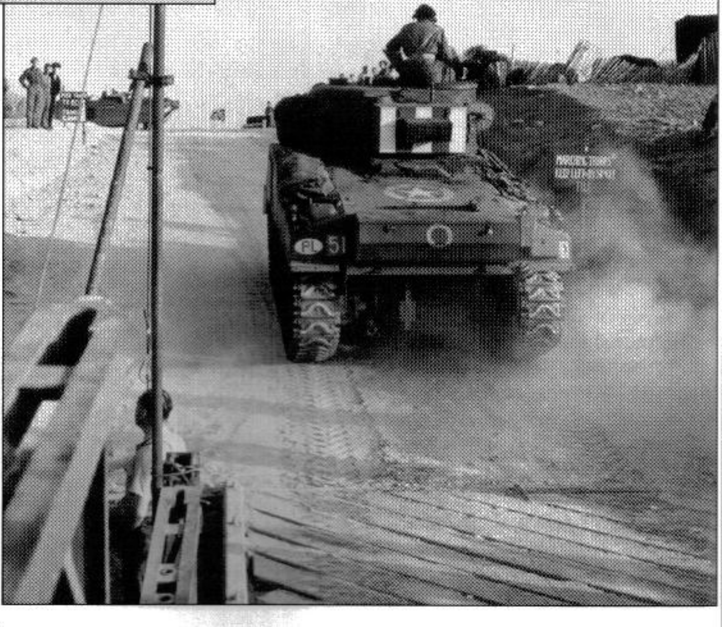
"Hurricane", a M4 medium tank with wading trunks of Co. H, 66th Arm'd Regt., 2nd Armored Division comes ashore from an LST at Utah beach on D+1. The 2nd Armored Division was the first US armored division ashore, and landed beginning on the second day of the landings. This gives a very good view of the circled white star used by the Allied forces on all armored vehicle for air identification; it was often repeated even larger on the engine deck. By July, it was being replaced by fluorescent cloth identification panels, as the marking was not distinctive enough to fast-moving Allied aircraft. (US Navy)



A M4 of Co. G, 66th Arm'd Regt., 2nd Armored Div. unloads from an LST at Utah beach on D+1 or D+2. All of the tanks of the 2nd Armored Div. were waterproofed with deep wading gear, as it was not known how soon clear channels could be opened past German beach obstructions to allow the larger LSTs to approach the beach. However, Army engineers and Navy Seebees were able to clear channels by the end of the D-Day.

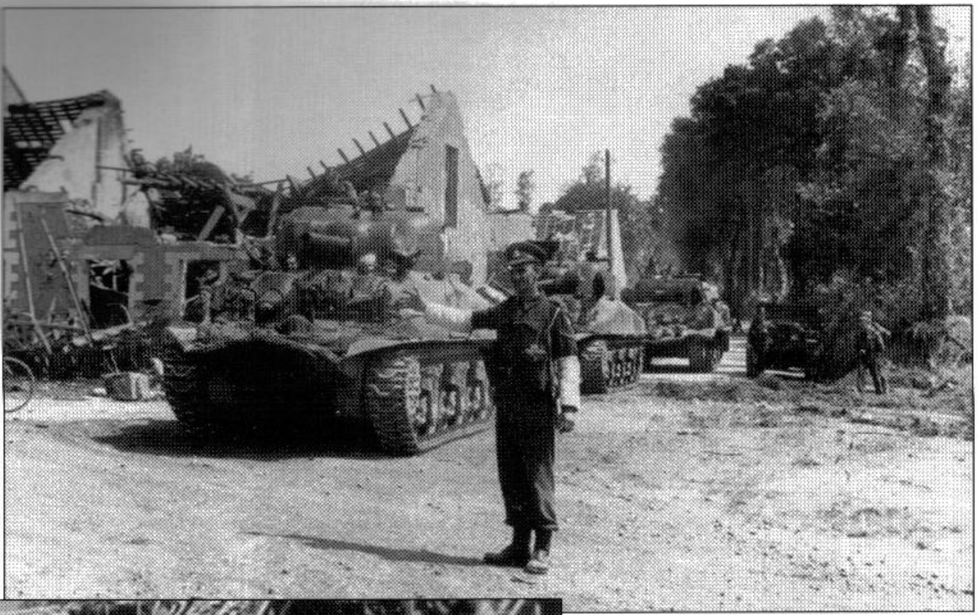


Another of the tank units landed to assist in the breakout operations was the French 2nd Armored Division, which landed at Utah Beach on 1 August. This is a M4A2 tank named "Pertrous" from the 12e Regiment de Chasseurs d'Afrique. Careful inspection of the right headlight framing will reveal a "SOMUA" plate, a reminder that many of these tank crews had served on a SOMUA 35.S tank when first stationed in French North Africa. (US Army)

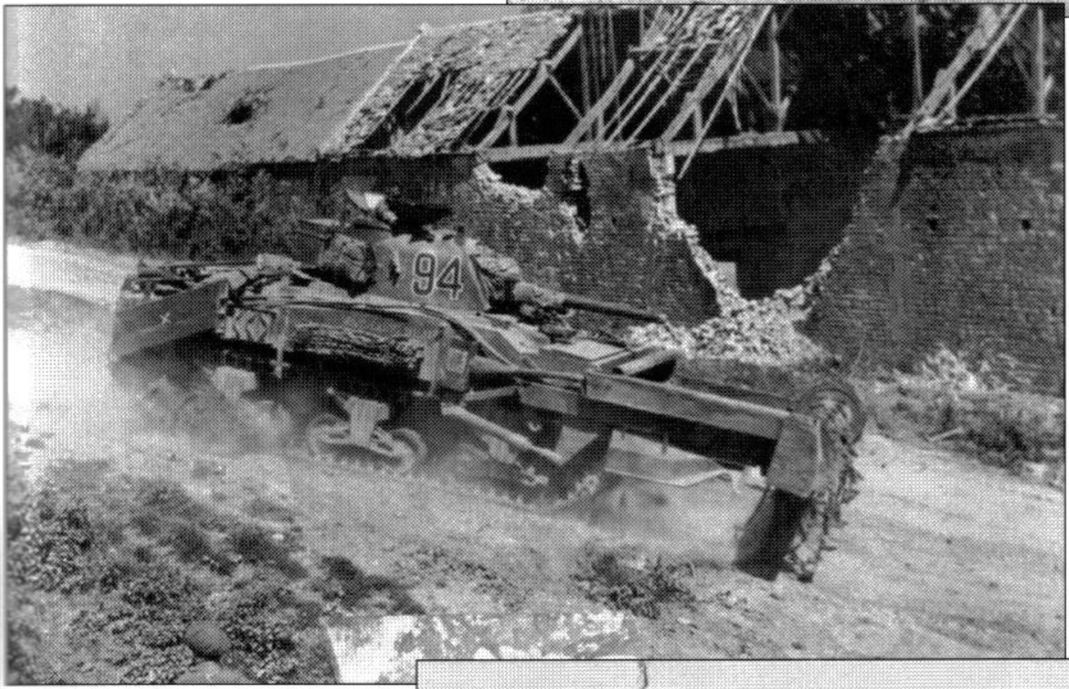


Tanks continued to pour ashore day after day along the Normandy coast. Here, a Sherman V of the Polish 10th Armoured Cavalry Bde., 1st Armoured Division comes ashore at Arromanches-les-Bains in late July. This was a return trip for many of the Polish tankers, who had fought in Renault 35.R tanks in the 1940 Battle of France, (and Vickers 6-ton tanks in Poland in 1939). The markings show this to be a C Squadron tank of the 1st Arm'd Regt.; the significance of the three white vertical bars on the rear of the turret are not known. (Sikorski Institute)

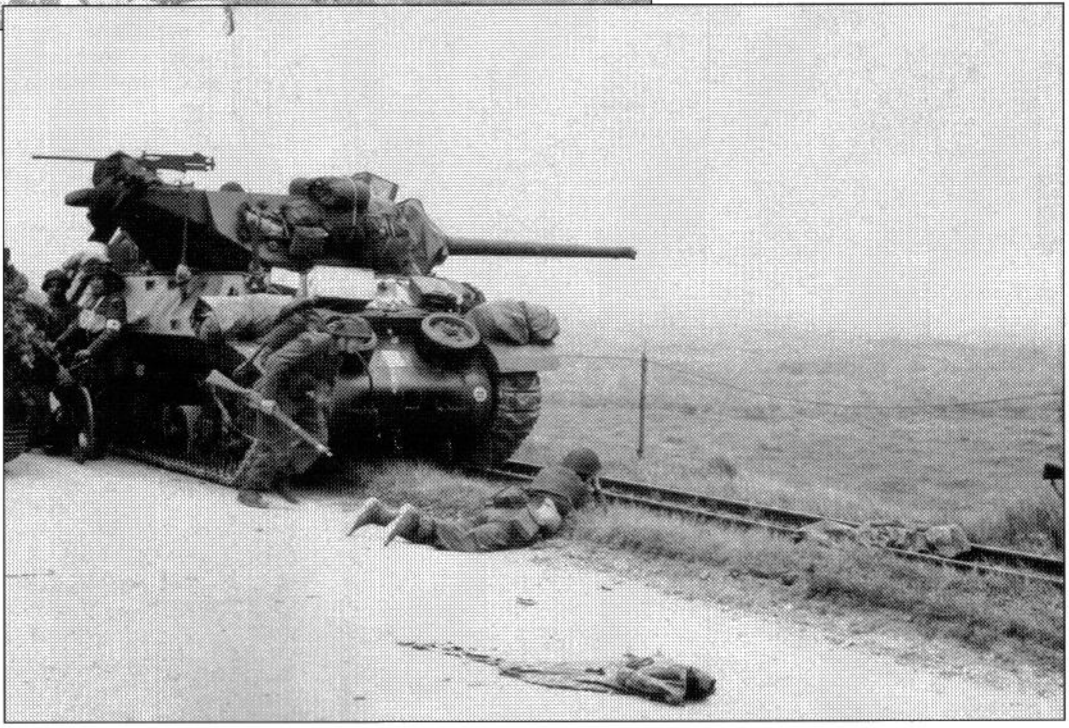
Defending the Beach-Head



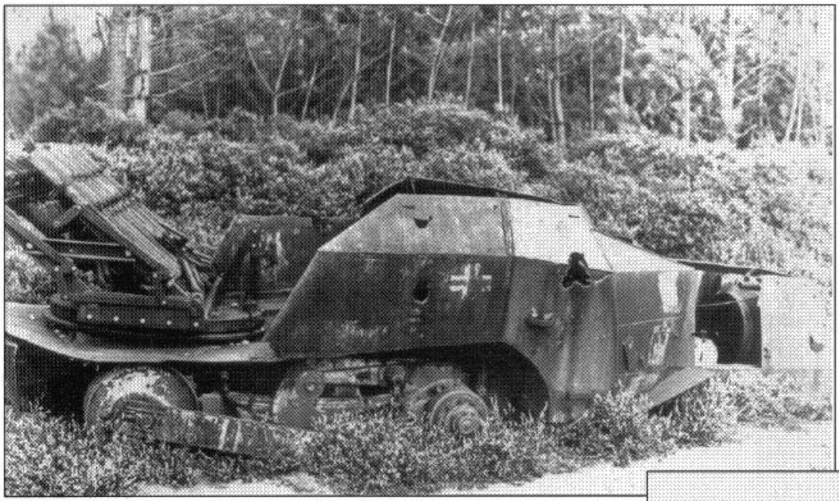
Once free of the beaches, the Duplex Drive Shermans shed their swimming skirts, as we see on this column of British Shermans passing through Douet. The DD tanks often retained the metal framing for the skirts, making them identifiable even with the skirts removed. (The Tank Museum)



The Sherman Crab was another British innovation that was widely used during the Normandy operation. The Crab was another Sherman engineer modification with a mine flail attached at the front. The large structure continued the powertrain which spun the flail chains in front of the tank which detonated mines. The device at the rear of the tank dropped lane markers to identify cleared areas. British flail tanks had been employed since the North African campaign and continually refined. (The Tank Museum)

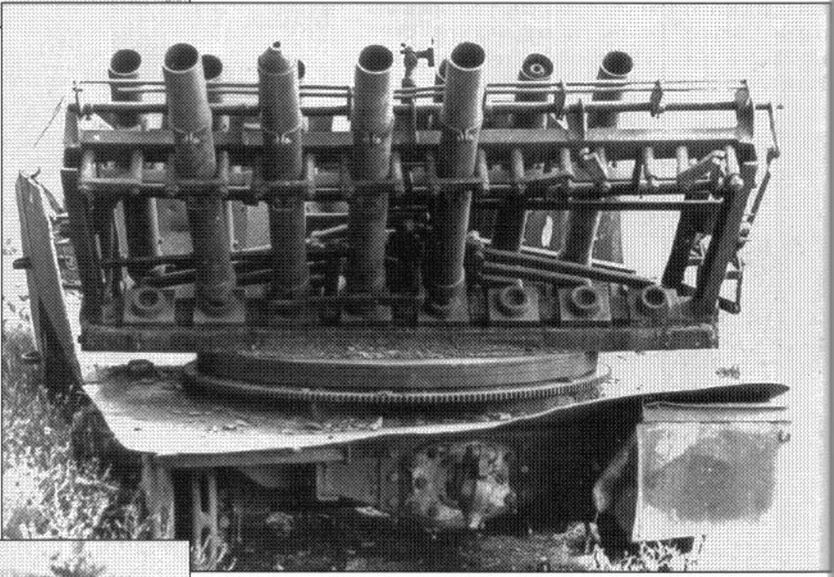


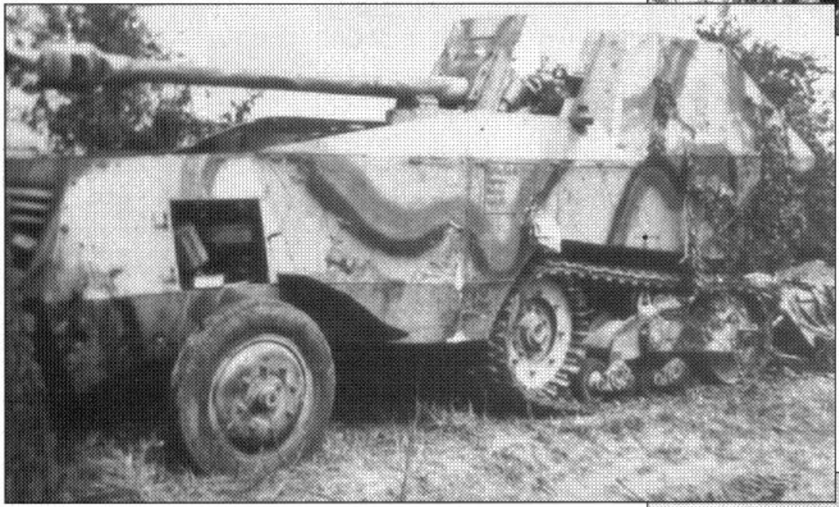
A M10 Achilles Mk. II engages German snipers while supporting 3rd Division infantry in early June in the area beyond Sword beach. The Achilles was the British name for the American M10 tank destroyer; the Mk. I was the early version with the triangular rear turret counter-weights, the Mk. II referred to the enlarged turret with the "duck-bill" counterweights at the rear of the turret. (The Tank Museum)



One of the most characteristic sights in the early Normandy fighting were a variety of bizarre armored vehicles based on French and British armored vehicles captured in the 1940 Battle of France. These vehicles were the brainchild of Alfred Becker, an artillery officer who served in the German artillery in France in 1940. Because of his family's industrial contacts back in Germany, Becker managed to have many captured vehicles shipped back to Alkett in Berlin-Spandau where they were rebuilt as self-propelled artillery. This unusual vehicle is a 20-barrel 81mm mortar rig mounted on an armored SOMUA MCG S 307(f) half-track. A similar mounting was also made on the SOMUA MCL half-track. (US National Archives, Federal Records Center-Suitland)

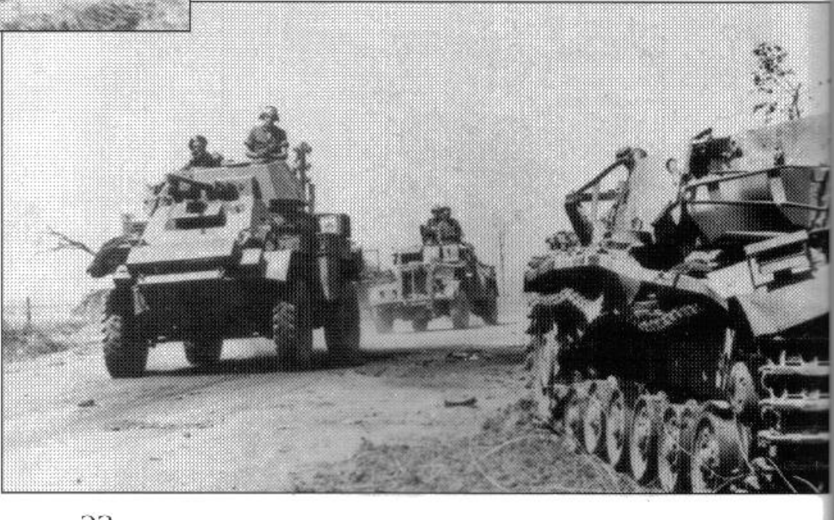
Becker's improvised self-propelled artillery was used mainly by the 21. Pz. Div. This detail view shows the unusual 20-barrel mortar launcher. It consisted of ordinary mortar tubes in a new contraption that allowed all 20 mortar bombs to be dropped down the tube simultaneously to fire an impressive barrage. Several of the mortar tubes are missing on this vehicle. (US National Archives, Federal Records Center-Suitland)

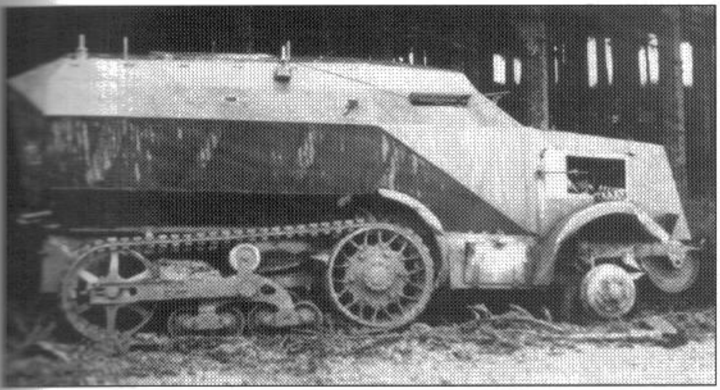




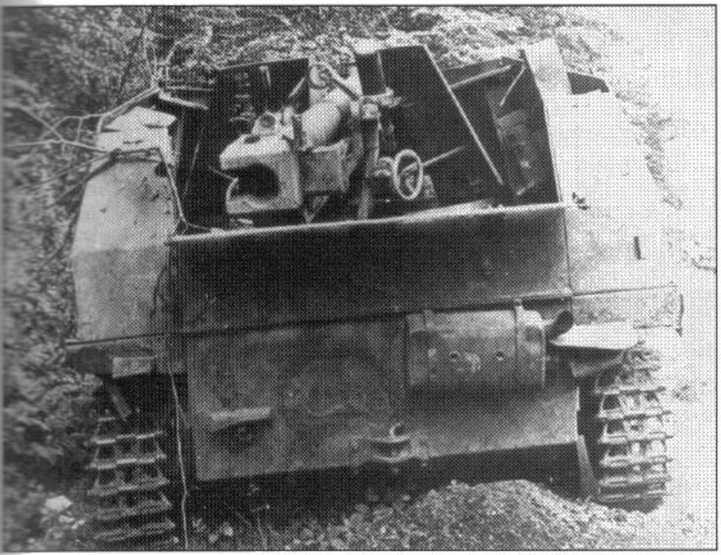
Another of Becker's bizarre improvisations was the Selbfahrlafette fur 7.5 cm PaK 40, based on an armored SOMUA MCG S 307 (f) chassis. Given the rather modest size of the French half-track, the recoil from this mounting must have been fierce. Nonetheless, it did give the very potent 75mm PaK 40 greater mobility than the usual towed version. (US National Archives, Federal Records Center-Suitland)

A British armoured recce unit moves forward past the wreckage of a German StuG III assault gun. The lead vehicle is a Humber Mk IV, and it is followed by a Humber Mk III light reconnaissance car. (US National Archives)

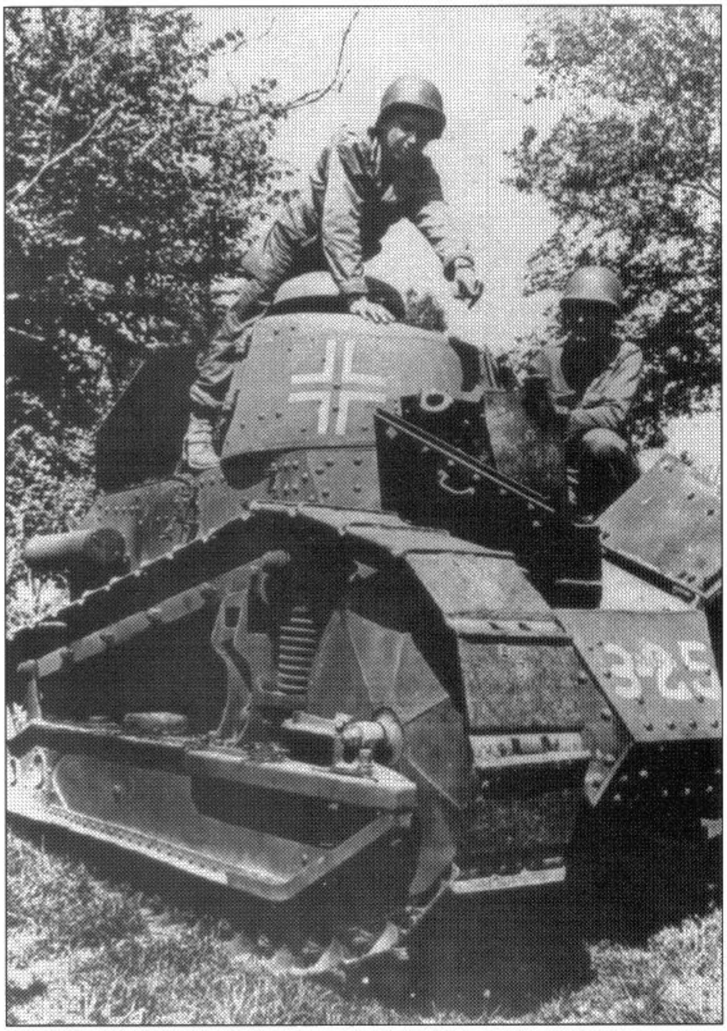




Yet another of the Becker armored vehicles, in this case, a French Unic P107 half-track converted into a Schutzenpanzerwagen U 304 (f) radio command vehicle. Appropriately enough, this command vehicle was usually used in conjunction with self-propelled artillery similarly built on captured French chassis. (US National Archives, Federal Records Center-Suitland)

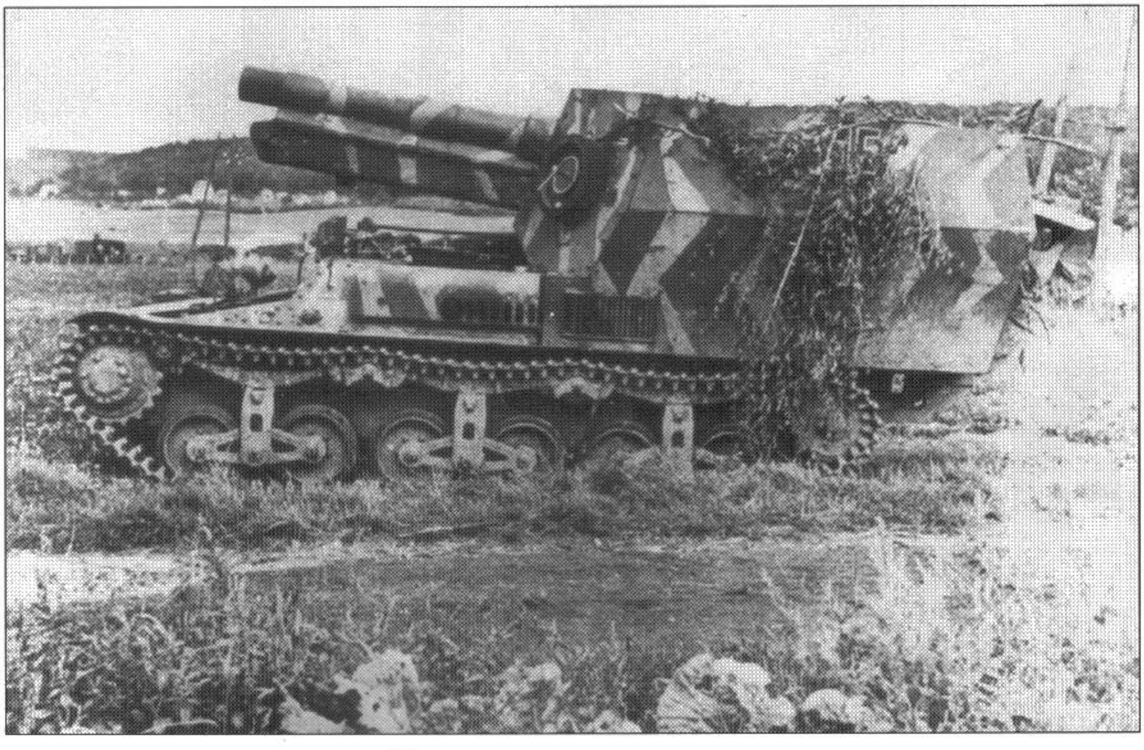


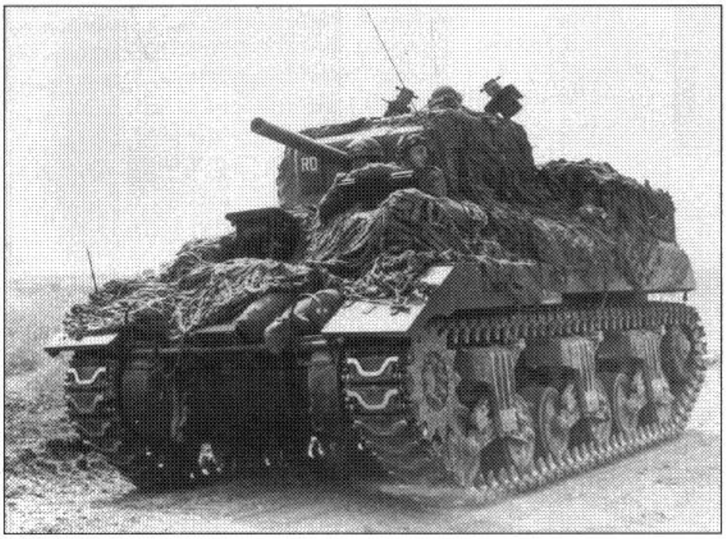
Fire support for the panzer divisions was provided by the Sd.Kfz. 124, popularly called the Wespe. This was a 105mm howitzer on the obsolete Pz.Kpfw. II chassis. This Wespe knocked out in Normandy has its entire recuperator assembly over the gun barrel missing; whether from combat damage or Allied action is not clear. (US National Archives, Federal Records Center-Suitland)



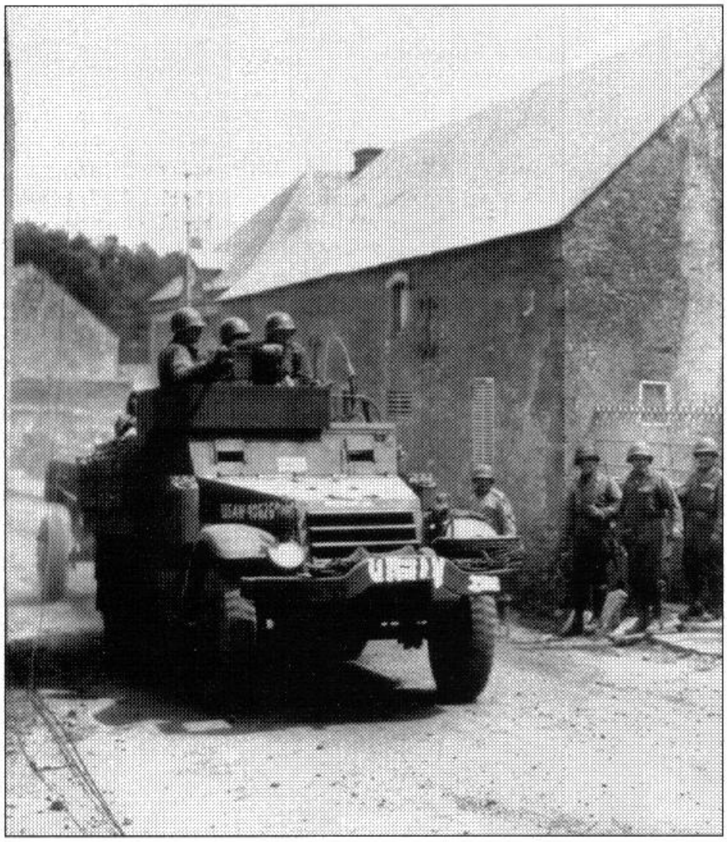
During the Normandy fighting, a number of old World War I-vintage Renault FT light tanks were encountered by Allied forces. These were used by German tank units for training duties, and in German security units for police actions and guard duty. The Luftwaffe also used the old tanks around airfields, both for runway security and for towing. Many FT turrets were cannibalized from non-functioning chassis, and employed on concrete shore bunkers along the Normandy coast. (US Army)

One of the more widely traveled of the Becker conversions was the 15 cm-sFH 13/1 auf Geschutzwagen Lorraine-S (f) Sd.Kfz. 135/1 which consisted of a German World War I-vintage 150mm field howitzer mounted on a French Chenillette Lorraine armored transporter. A total of 72 of these were built by the Baukommando Becker in Paris, and some served with 21. Pz.Div. in the North African campaign. In 1943, the survivors equipped the "Verstarken Schnellen Brigade West" and in the summer of 1944, 45 were attached to the Pz.Art.Rgt. 155 of 21.Pz.Div. along with 43 similar conversions on Hotchkiss light tank chassis. This vehicle, captured by the US Army, has a particularly elaborate splinter camouflage. (US Army)

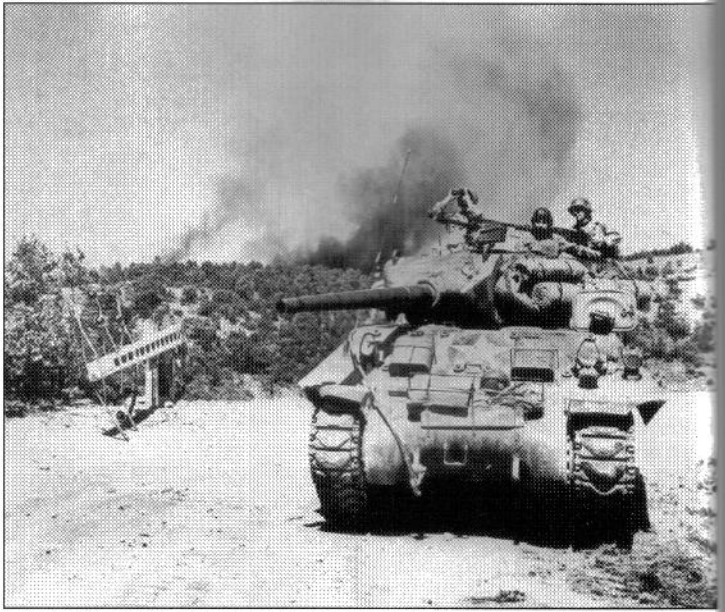




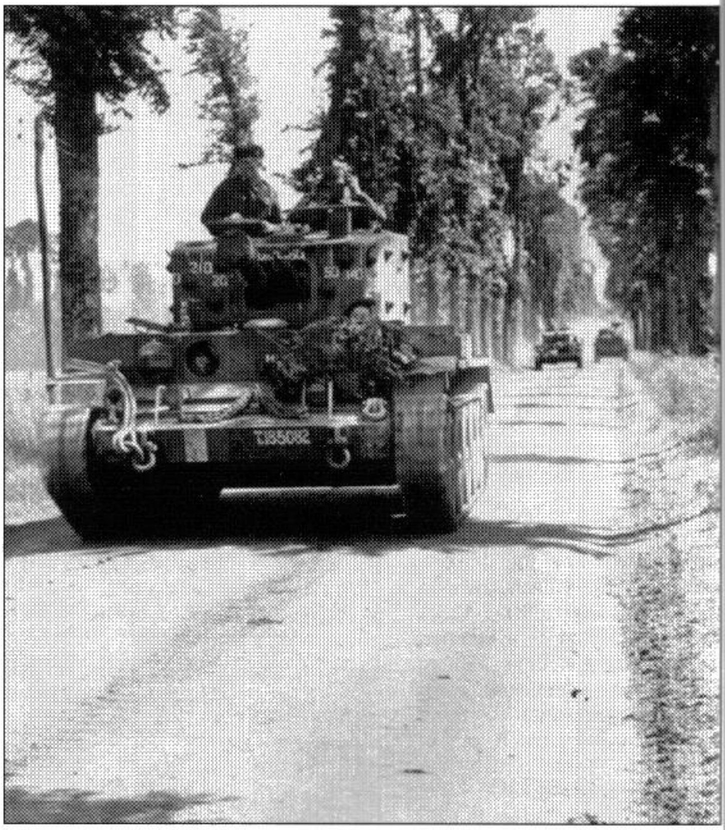
The Canadian built Ram tank, a contemporary of the early Sherman, never saw combat in Canadian tank units, but small numbers were used in self-propelled artillery regiments by troop commanders in lieu of Shermans as the Ram OP. The Ram's main failing was that by 1944, its 6 pdr. main gun was inadequate and Shermans were available in sufficient numbers to equip the Canadian armored units. The RD insignia evident on the gun mantlet indicates that this is a tank of the troop commander of D Battery; the Ram of the gun position officer would be marked with a GD. (Public Archives of Canada)



A US Army M3A1 half-track personnel carrier belonging to a tank destroyer battalion drives through a French village in Normandy on the way to the front. The M3A1 half-track was the standard US Army armored infantry transporter during the campaign, and was widely used in other roles as seen here. Careful inspection of the photo will reveal that it is towing a M3 76mm anti-tank gun, a towed version of the weapon on the M10 tank destroyer. These towed tank destroyer battalions were not particularly successful due to the lack of mobility and weak protection of their gun crews, compared to the self-propelled battalions. As in many official photos from the summer of 1944, the censor has blotted out the unit bumper codes on the photo for security reasons. (US Army)

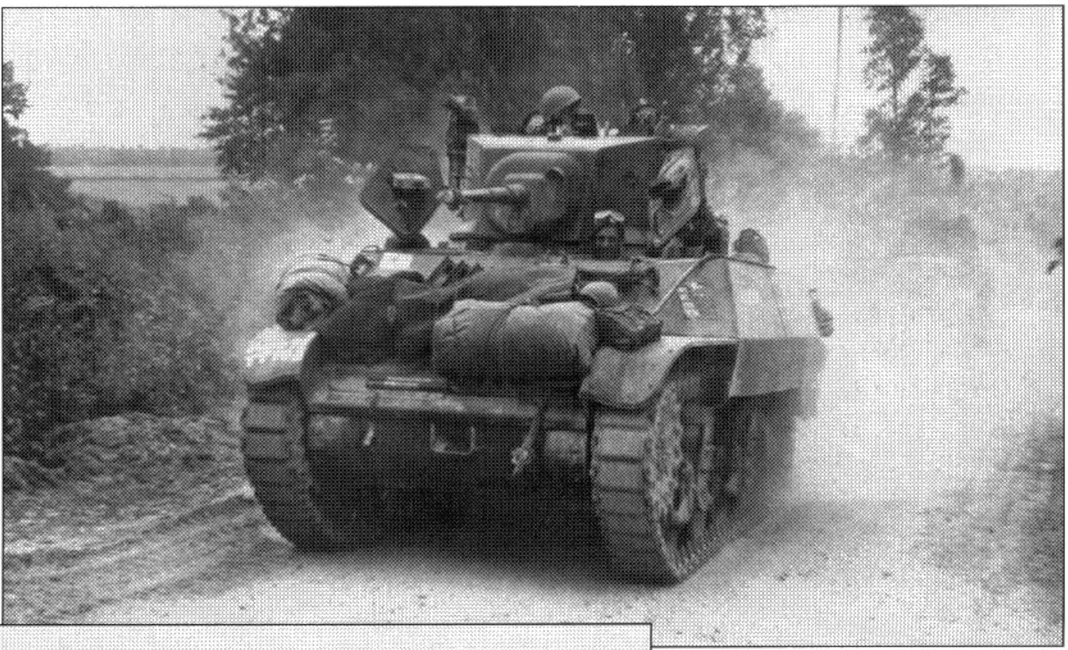


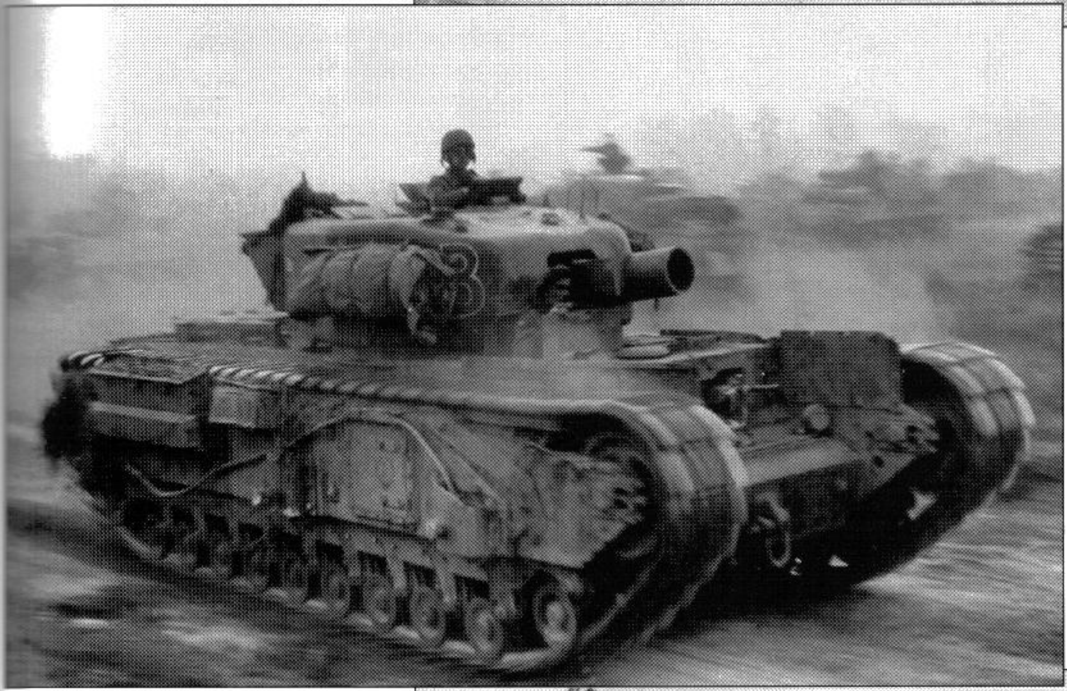
A M10 tank destroyer guards the approaches to the beaches in the American sector a few days after the landing. The M10 was armed with a 3 inch gun, offering better armor penetration than the 75mm gun on the Sherman. However, with the standard M61 APC ammunition available in June, it could not frontally penetrate the armor of the German Tiger I tank, and had difficulty penetrating the Panther's armor at ranges over 500 yards. (US Army)



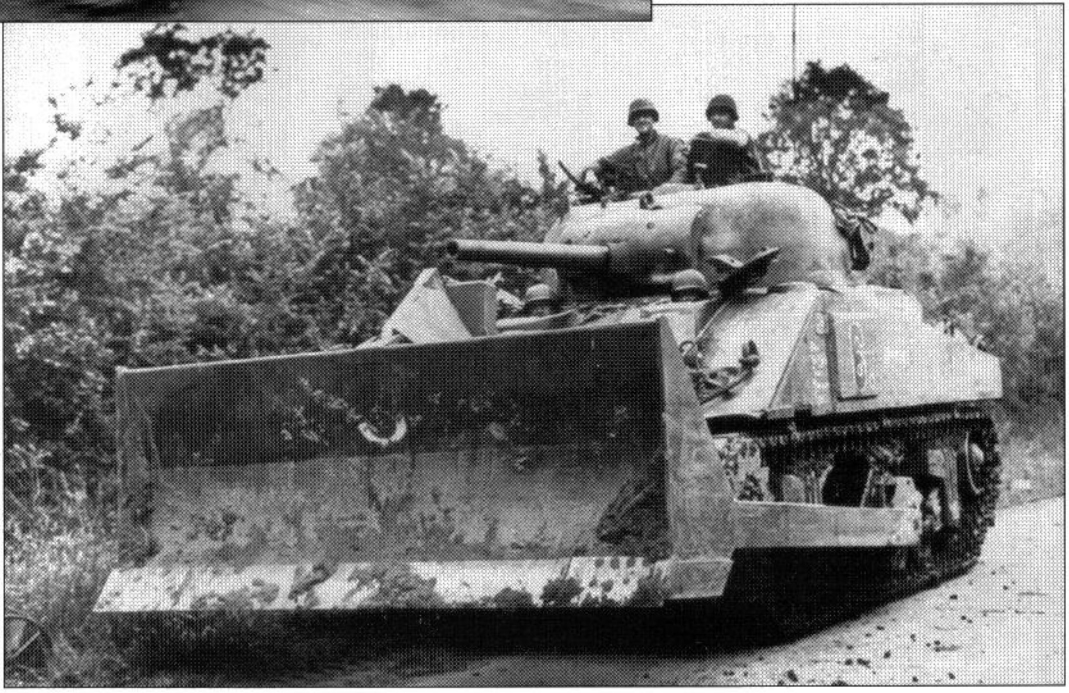
One of the less common British tanks fighting at Normandy was the Centaur IV close-support tank, an early relative of the better-known Cromwell. Only 80 of this type were built, and it was armed with a 95mm howitzer. In the Normandy landing, the Centaur IVs equipped the Royal Marine Armoured Support Group with the 1 RM Armd Spt Regt. at Gold, the 2 RM Armd Spt Regt. at Juno and a battery of the 5 RM Armd Spt Regt. at Sword. The original plan was to have the Centaurs positioned on armored LCTs to act as close-range, off-shore gunboats in the initial stage of the landings. However, the landing craft did not prove as seaworthy as hoped, and so most of the Centaurs were landed and fought ashore. Each troop had two Centaur IVs and one Sherman for the troop leader. The extensive marking around the turret was intended to simplfy fire direction on the LCTs. This battery is in action near Tilly-sur-Seulles on D+9. (The Tank Museum)

The standard recce tank in the British armoured divisions in Normandy was the Stuart V (M3A3), seen in action on 15 June near Bayeux-Tilly with the 7th Armoured Division. The division's legendary Desert Rat insignia can be barely seen on the upper right corner of the glacis plate in front of the co-driver position. Although automotively improved over the Stuart versions used in North Africa, its firepower was no better. (The Tank Museum)



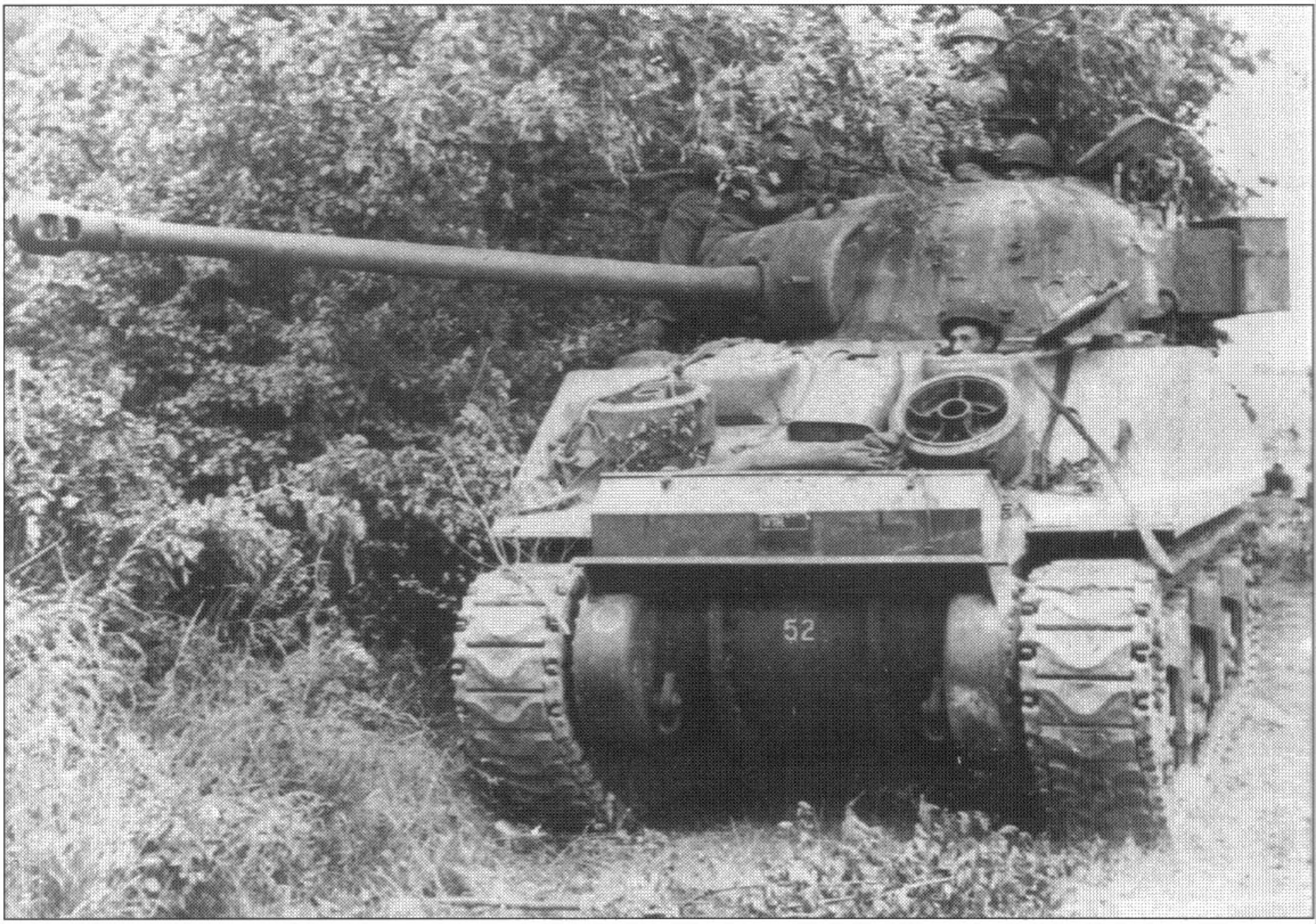


A Churchill IV AVRE barreling along a road in Normandy. The AVRE version of the Churchill is easily distinguished by the enormous bore of the Petard launcher mounted on the turret front. The Churchill was generally popular in the British tank brigades because of its thick armor, but it was slow and underpowered compared to other Allied tanks. Unlike the Sherman, none were upgunned with the 17 pdr., which limited the effectiveness of Churchills in tank-vs.-tank combat. (The Tank Museum)

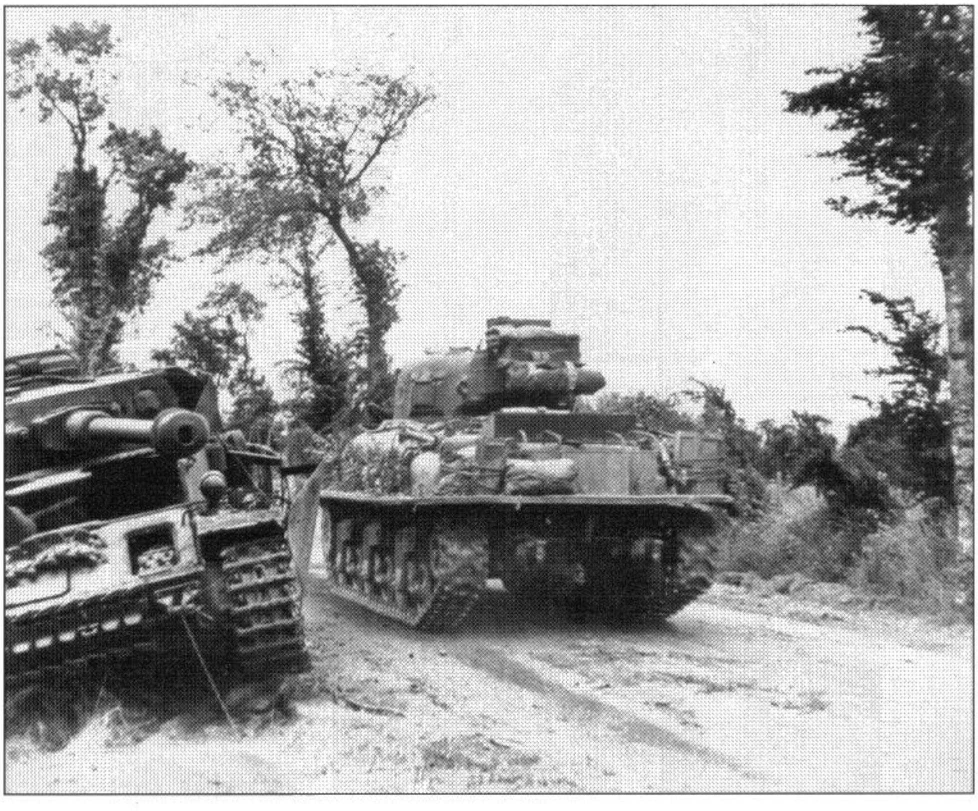


A M4 dozer tank named "Apache" of Company A, 70th Tank Battalion in the area beyond Utah beach in June 1944. The M1 bulldozer kit was one of the few US Army engineering innovations used at Normandy. Besides proving useful in the invasion itself, the dozer tanks proved invaluable in the bocage fighting to help clear lanes through the thick hedgerows. (US Army)

Initial Fighting near Caen

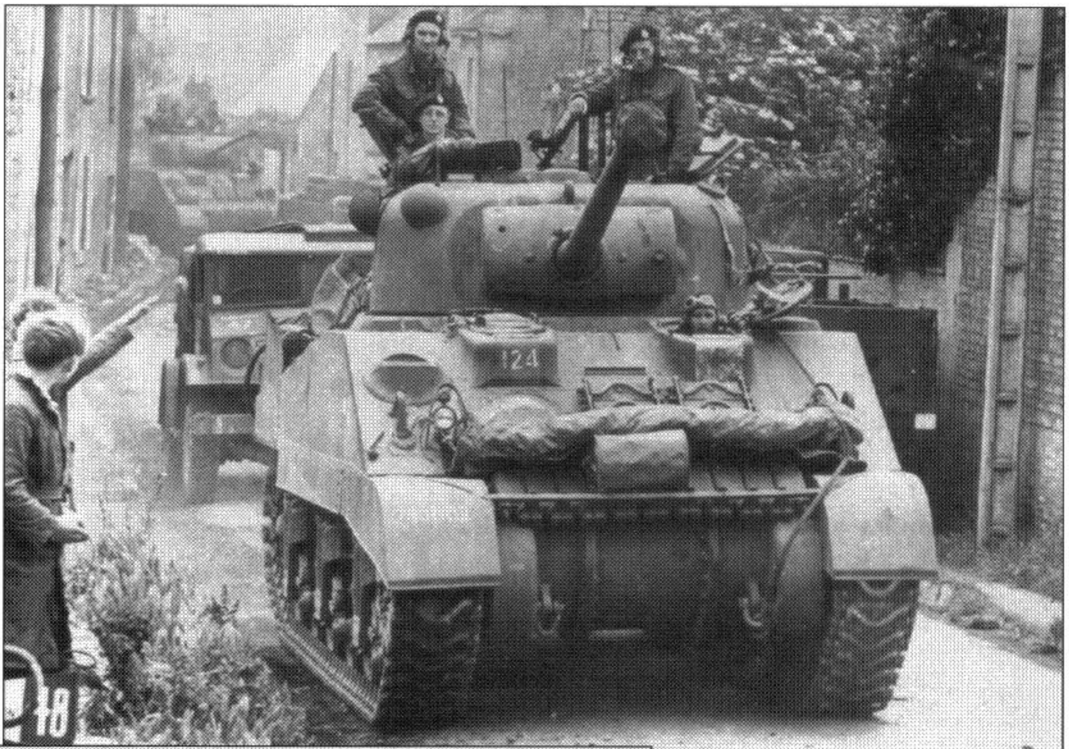


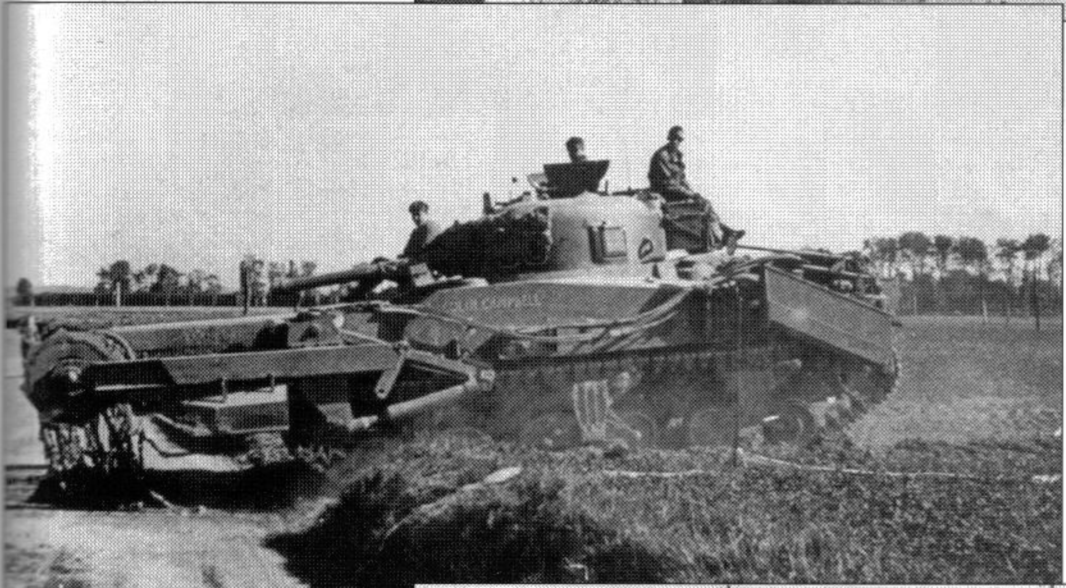
A good view of the long barrel of the 17 pdr. gun on a Sherman Vc Firefly of the 11th Armoured Division while supporting the South Lancashire Regt. in mid-June 1944. The circular insignia on the right transmission housing reveals this tank to belong to a C Squadron, and the white 52 on a red square indicates it is in the second most senior regiment of the 29th Armoured Bde., the 2nd Fife and Forfar Yeomanry. (The Tank Museum)



A Sherman II DD tank passes by a thoroughly destroyed Pz.Kpfw. IV several weeks after the Normandy invasion. The Pz.Kpfw. IV, probably an Ausf. H or J, has had its glacis plate caved in and part of its roof armor smashed, which suggests a hit by a large high explosive round like an aircraft rocket or bomb. The Sherman DD has the extensive swimming skirt removed, but careful inspection of the lower rear of the hull will reveal the two power transfer housings which turned two propellors when the tank was fitted for amphibious operations. (The Tank Museum)

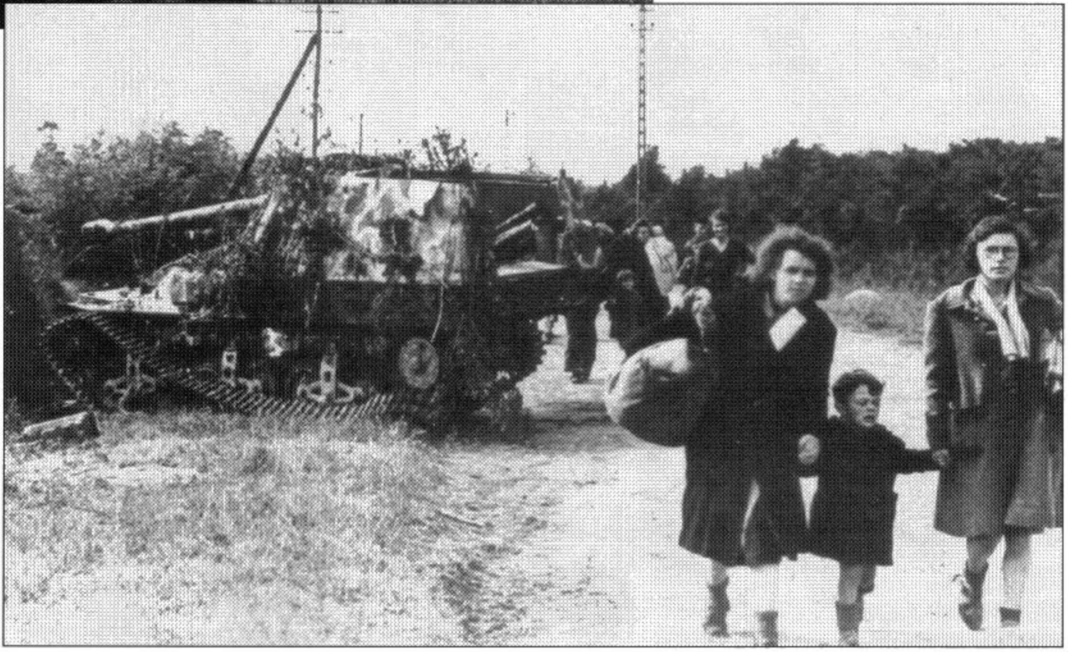
A Sherman Vc Firefly of the 4 RTR passes through a French village on 8 June. The tactical sign, a white 124 on a red square, was the characteristic numbering of a tank in an independent brigade rather than in one of the divisional armoured brigades. This photo clearly illustrates one of the other important changes made on the Firefly: the addition of a turret roof hatch for the loader. (The Tank Museum)

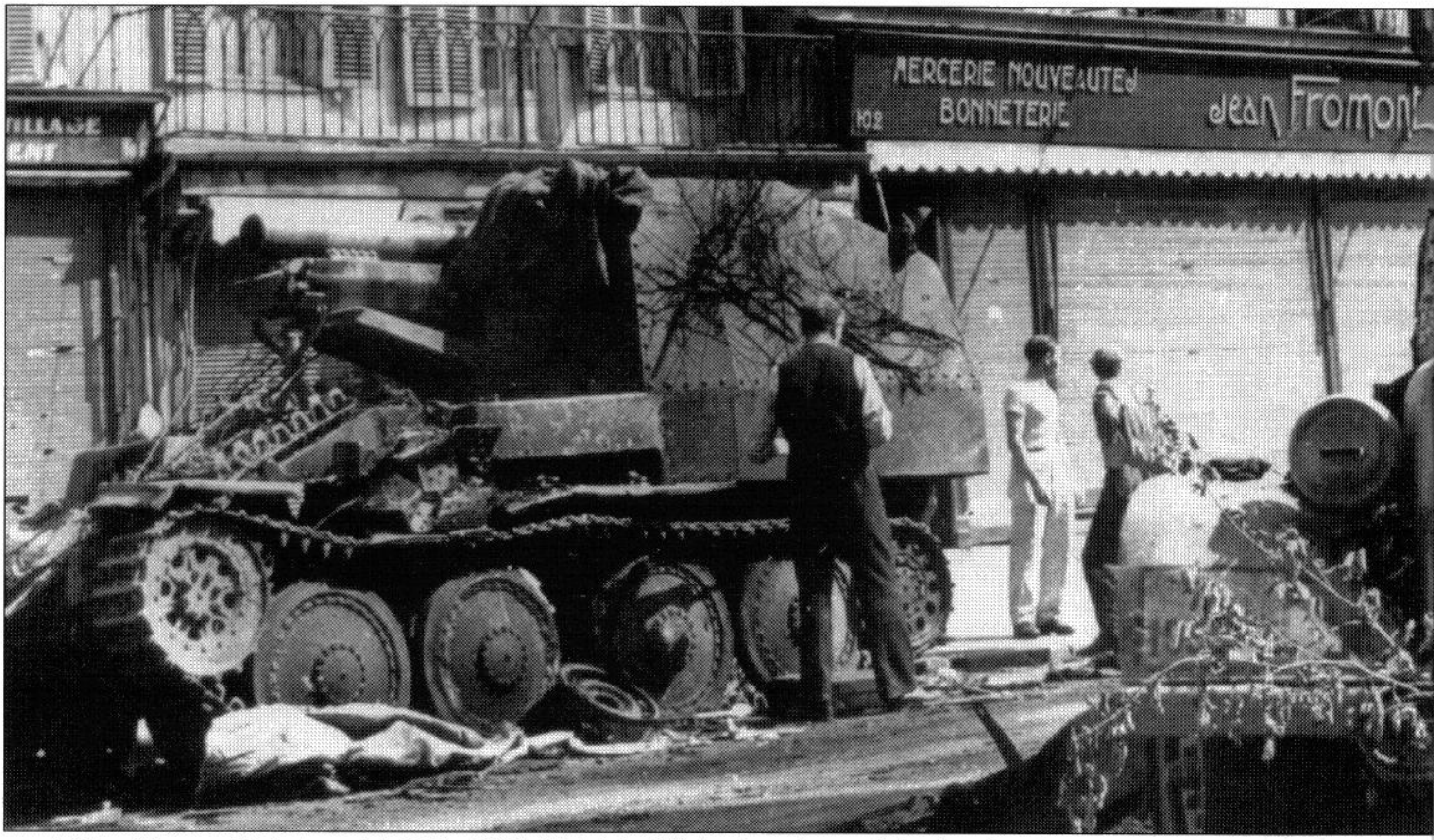




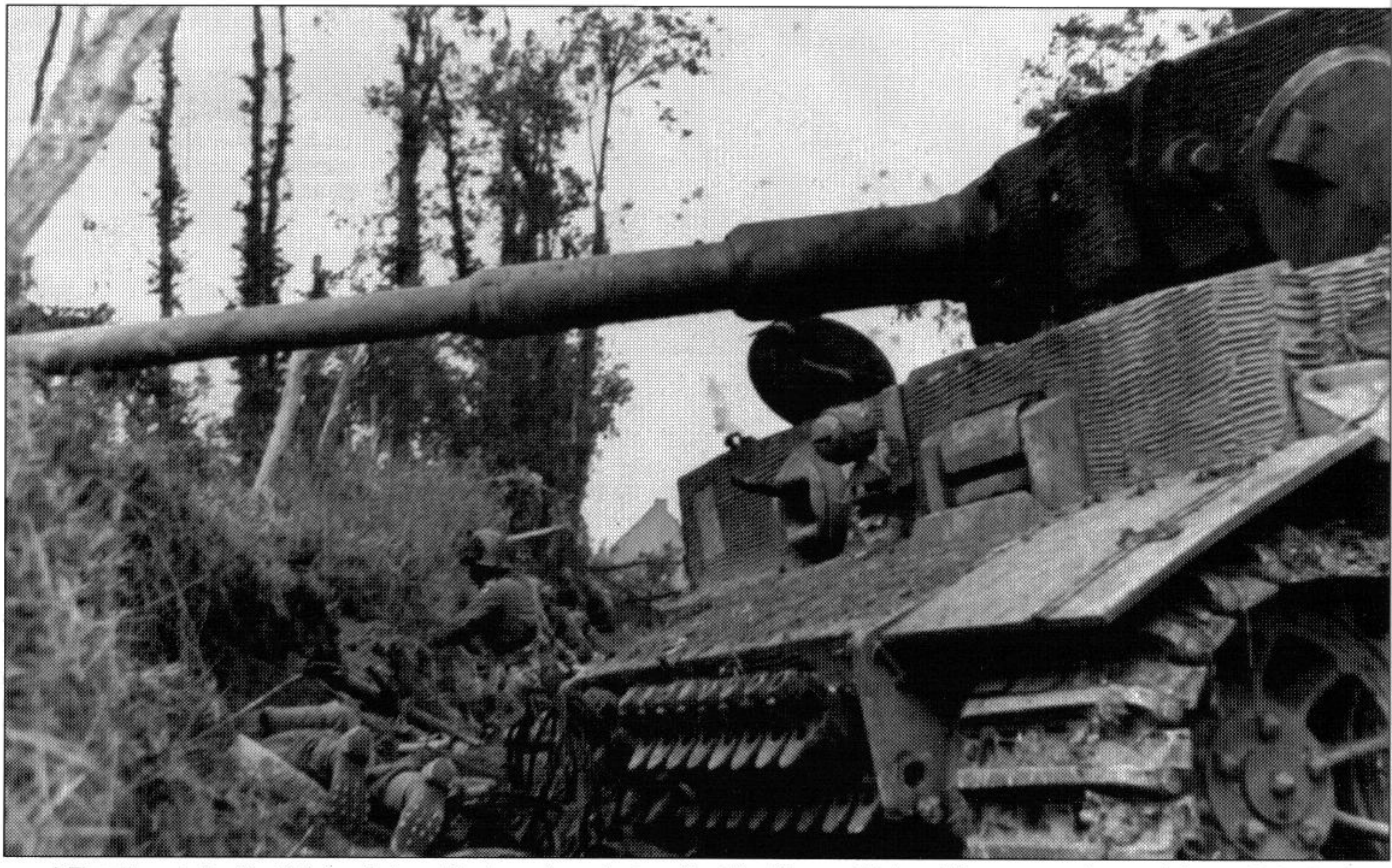
A Sherman Crab named "Colin Campbell" moves forward with the 79th Armoured Div. to help clear minefields. The Crabs were kept very busy in the July fighting due to extensive German minefields near Caen. In this photo, it can be seen that engineers have already marked a cleared lane in the traditional fashion with tape. (The Tank Museum)

French families flee the fighting in the Norman farm country on 21 June 1944. In the background is a knocked out 7.5cm PaK 40/1 auf Geschutzwagen Lorraine Schleepper (f), another of the myriad Becker conversions so typical of the early Normandy fighting. This was an improvised tank destroyer consisting of the very potent 75mm PaK 40 anti-tank gun on a captured French Chennilette Lorraine armored transporter. Although thinnly armored, the conversion gave the weapon more mobility. (US Army)



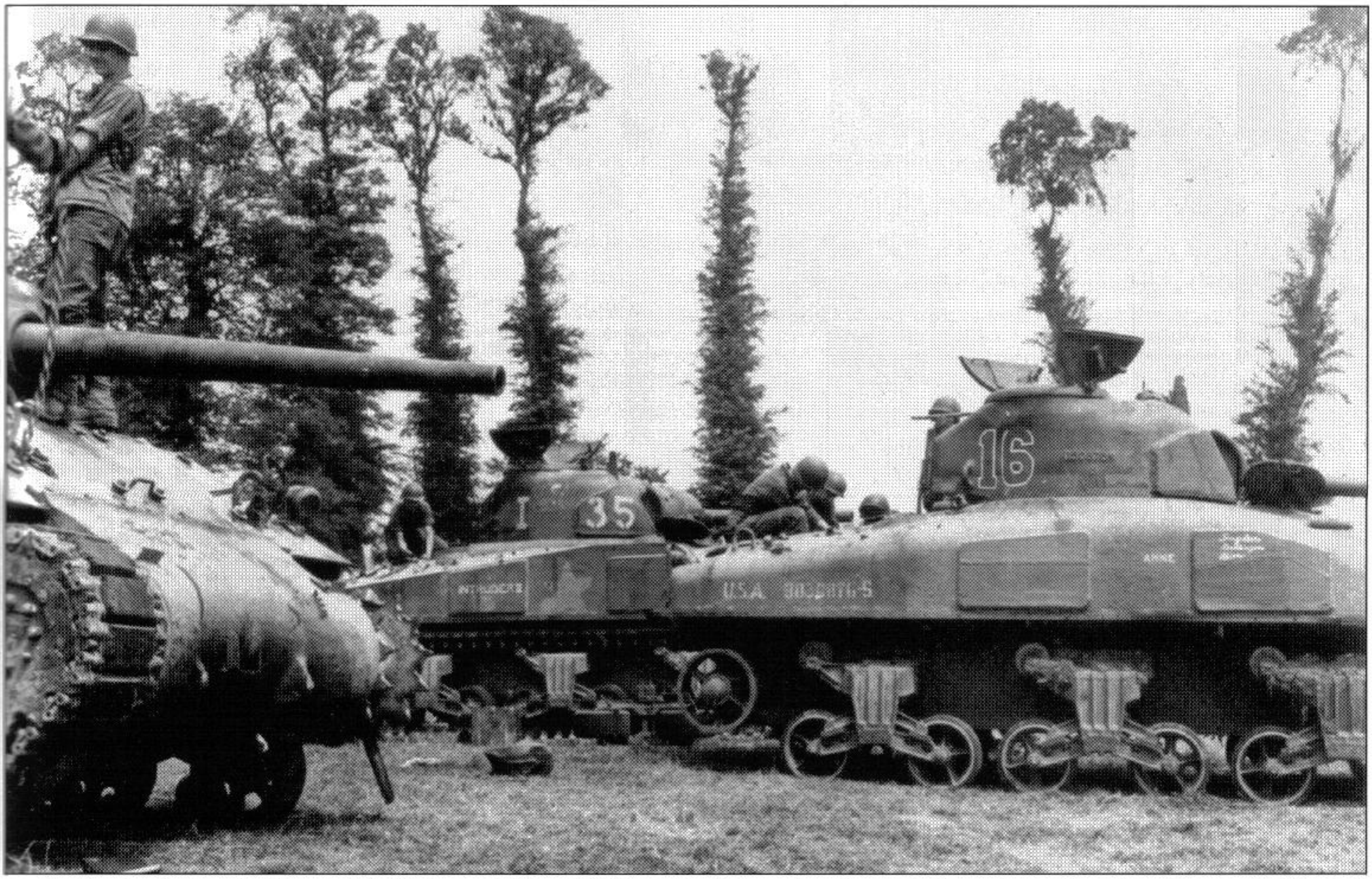


A 15cm Schweres Infanteriegeschutz 33/1 auf Selbstfahrlafette 38(t) lies burned out and abandoned on the streets of a Norman town in July 1994, apparently from a direct tank-gun hit on the side. This self-propelled howitzer was a common weapon in panzer-grenadier howitzer companies, and they were commonly called "Grille". A similar tank destroyer version, the Marder III, was built using the 75mm PaK 40 anti-tank gun instead. (US Army)

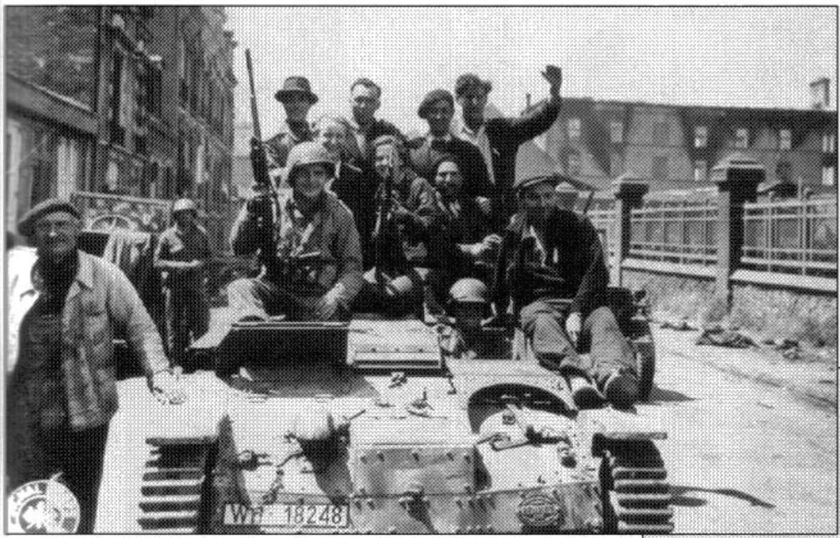


A Tiger I knocked out by British units lies at the base of a gully along the Odon River on 28 June. This appears to be a tank from s.SS-Pz.Abt. 101. Although many of the British anti-tank weapons were ineffective against the Tiger in frontal fighting, the Tiger was vulnerable when attacked from the side by the standard 75mm tank gun. The 1st company of this unit lost 15 of its 45 Tigers in the June fighting, and was pulled back to re-equip on the new Koenigstiger in July, leaving the remaining Tigers in the fray with British forces around Caen. (The Tank Museum)

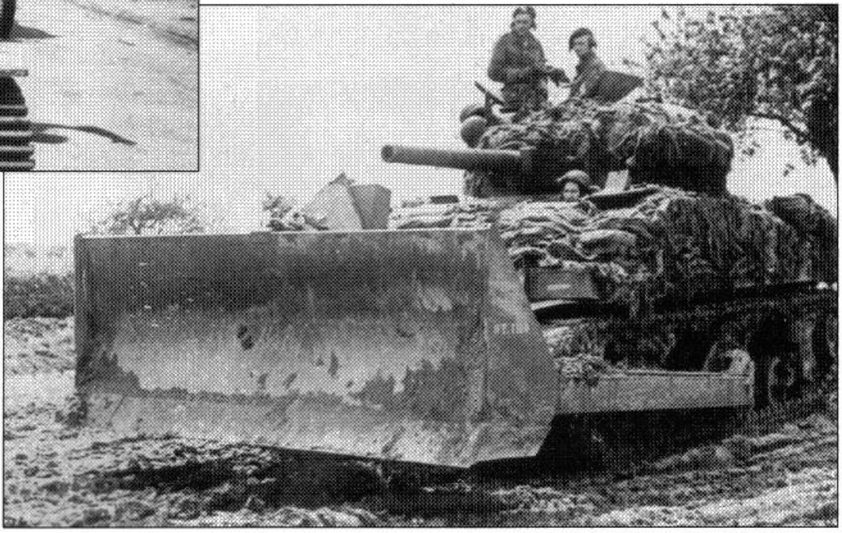
The Contentin Fighting



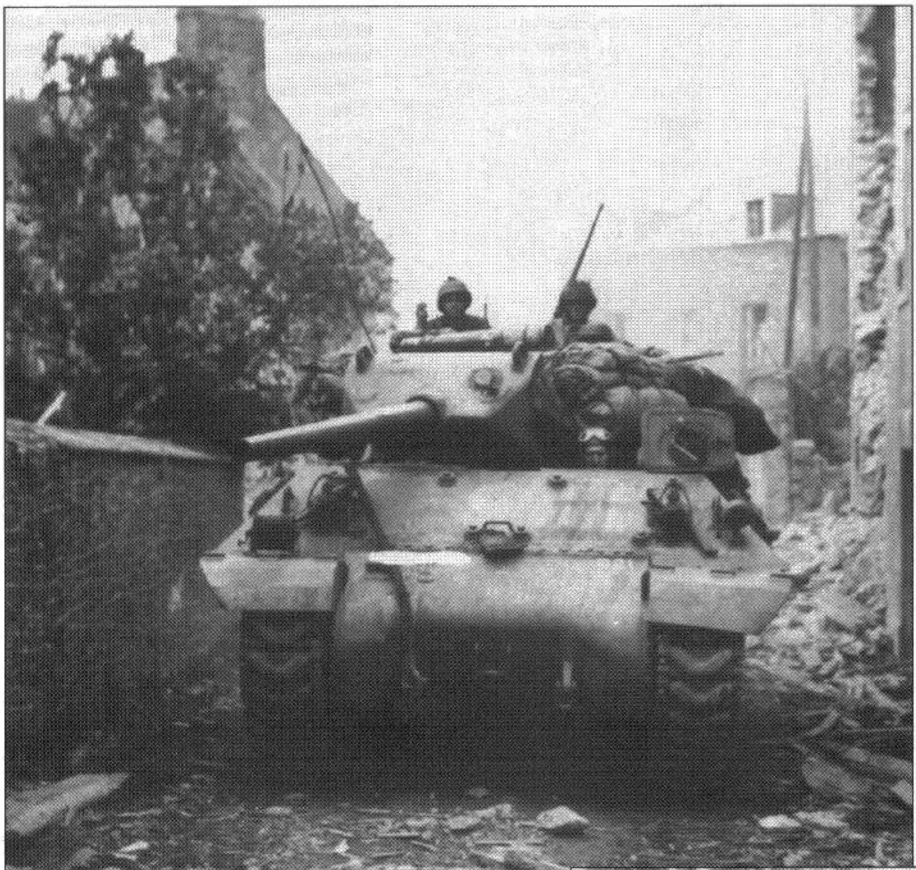
An American tank park in Normandy in late June with M4 and M4A1 medium tanks undergoing repairs. From the markings, it would appear that the tank in the rear is from the 2nd Armored Div., while the tank in the center appears to be from 70th Tank Bn. Notice that by this stage of the fighting, the prominent white star markings have largely disappeared: they were too tempting a target for German anti-tank gunners. (US Army)



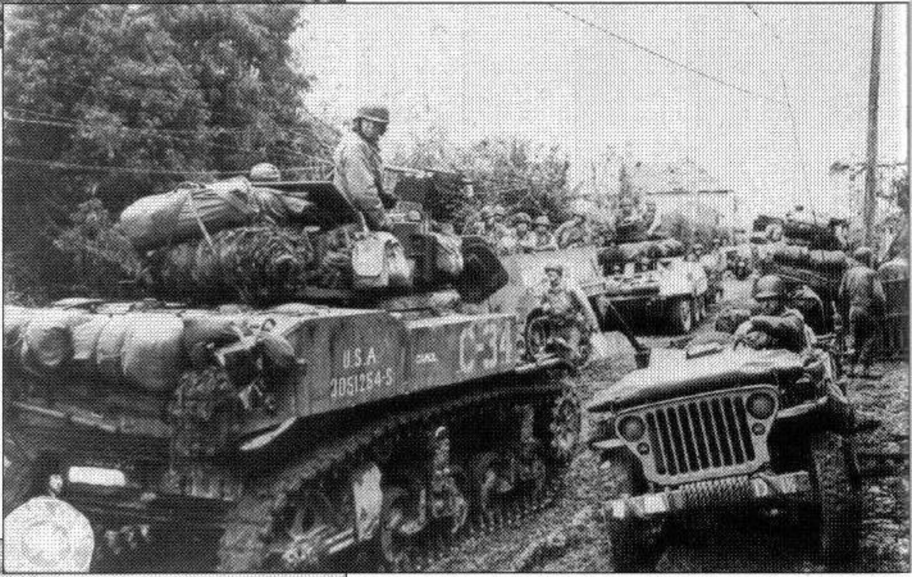
French citizens celebrate liberation with a pair of GIs of the 9th Infantry Div. driving a captured Renault UE armored tractor, probably in the outskirts of the port of Cherbourg. Cherbourg was the major strategic objective of the US 1st Army in the first month of Normandy fighting, in order to secure a port for further supplies. The UE was widely used by German forces in the area for utility roles such as transporting equipment. (US Army)



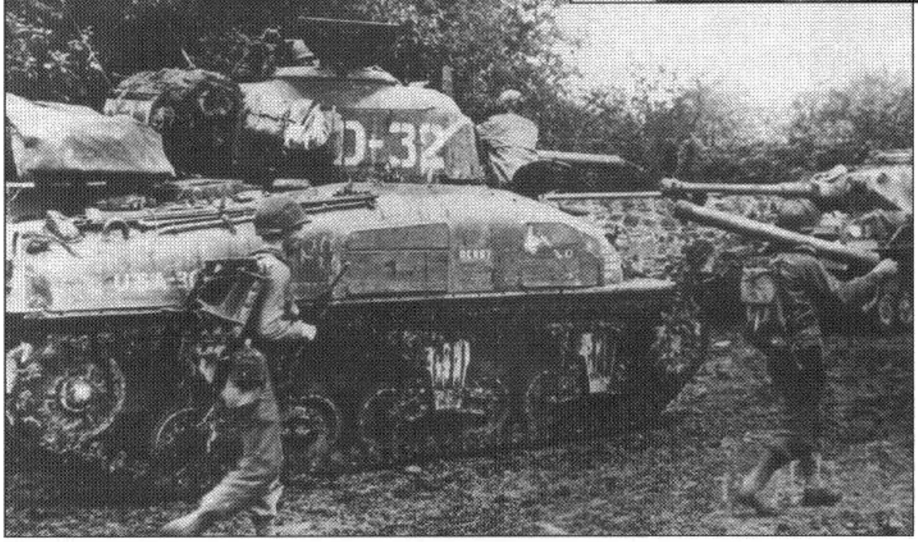
Although a common enough sight in US Army tank units, the Sherman with M1 dozer blade was far less common in British units as seen here. Note the tanker's helmets stowed outside the turret- a necessary substitute for the jaunty British tanker's beret in the Normandy fighting due to the presence of skilled German snipers. This Sherman V is well camouflaged with netting.(The Tank Museum)



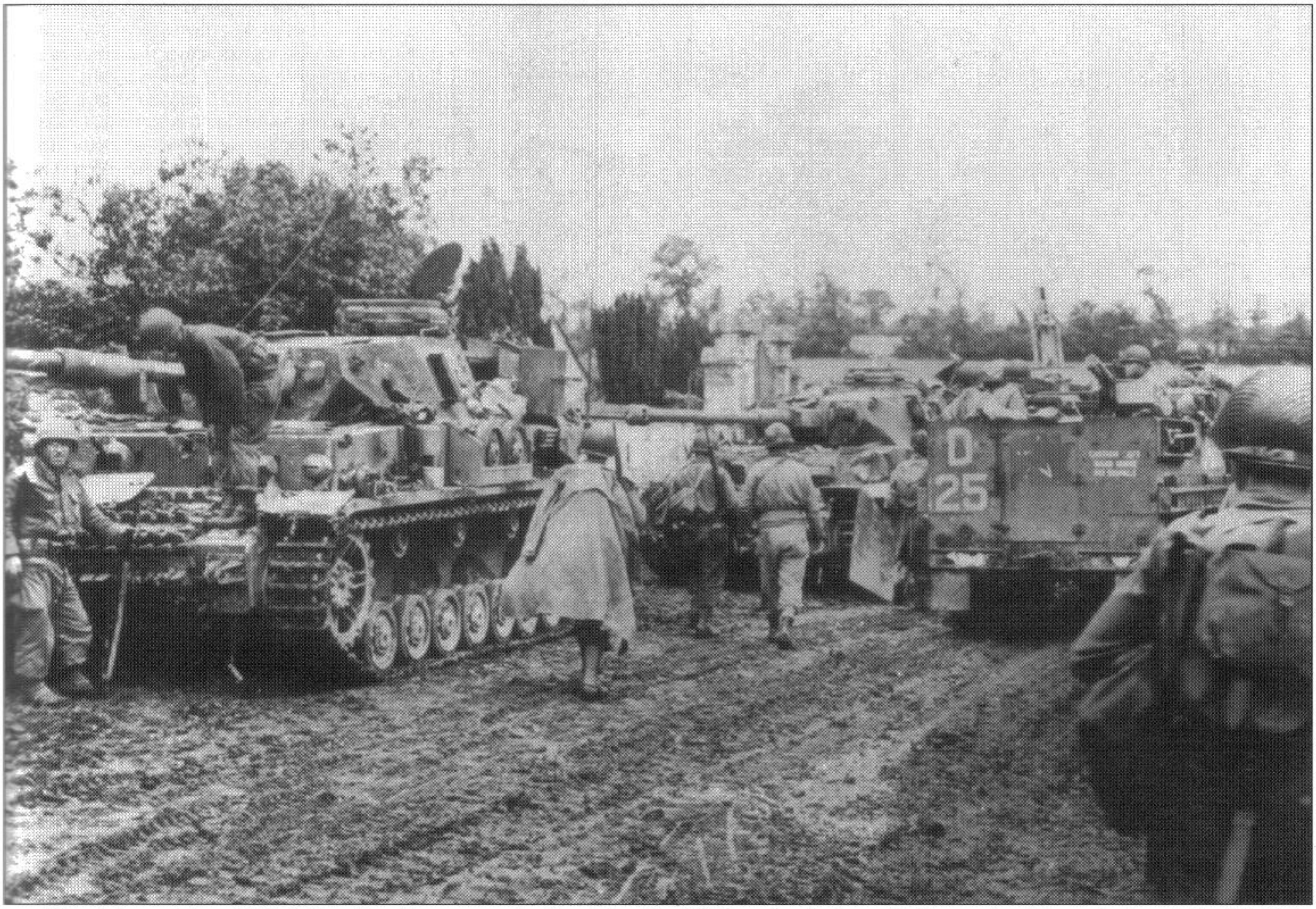
A US Army M10 3 inch tank destroyer, probably from the 823rd Tank Destroyer Bn., advances through the rubble of the town of St. Fromond on 7 July 1944 during the fighting towards St. Lo. St. Fromond was a road junction on the N174 road, and so the site of considerable fighting in early July as US Army units moved southwest out of the immediate bridgehead. This photo shows the traditional traveling mode of the M10, with the barrel traversed to the right so that the driver could keep his head popped out of the hatch. (US Army)



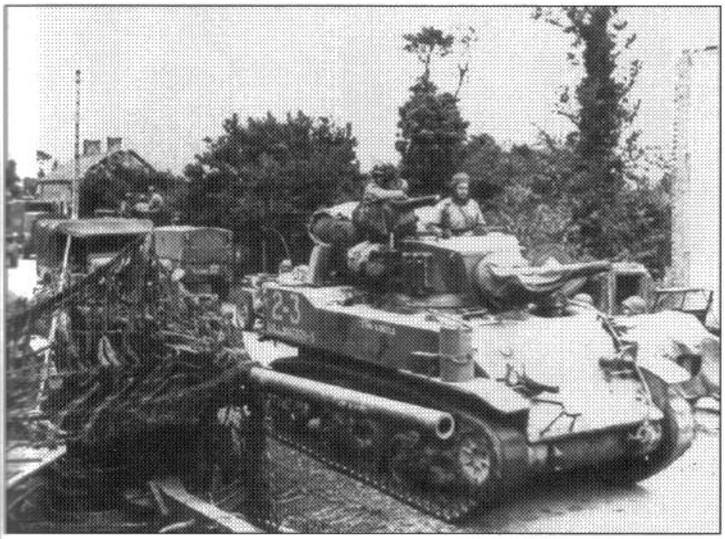
This is the first of a series of related photos of a column from the 33rd Armored Regt., 3rd Armored Division in the eastern outskirts of St. Fromond on 8 July 1944. This action was shortly after the combat debut of the 3rd Armored on the night of 7 July against 2.SS-Pz.Div. Das Reich near Pont Hebert. This view shows a heavily stowed M5A1 light tank of Co. C, named "Carol" as it passes along a road crammed with other vehicles from the division, including a jeep to the right, and a half-track and M8 scout car to the left. This photo was taken prior to a push across the Vire river, intended to head-off a German tank thrust towards Haut Vents. (US Army)



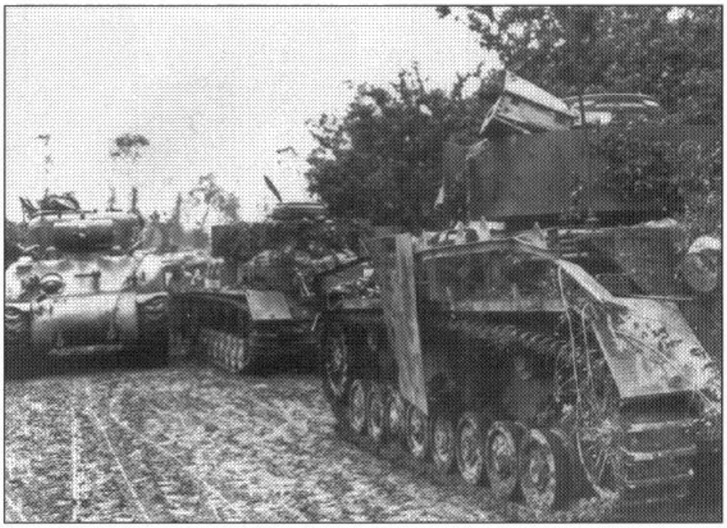
Another view on 9 July near St. Fromond where the first clashes occured between the 2.SS-Pz.Div. and US Army forces in the area. This M4A1 medium tank named "Derby" of Co. D, 32nd Armored Regt., 3rd Arm'd Div. moves down a muddy road, with an 81mm mortar team walking past, one GI carrying the baseplate, and the other, the tube. To the right is a knocked out Pz.Kpfw. IV of 2.SS-Pz.Div. Das Reich. (US Army)



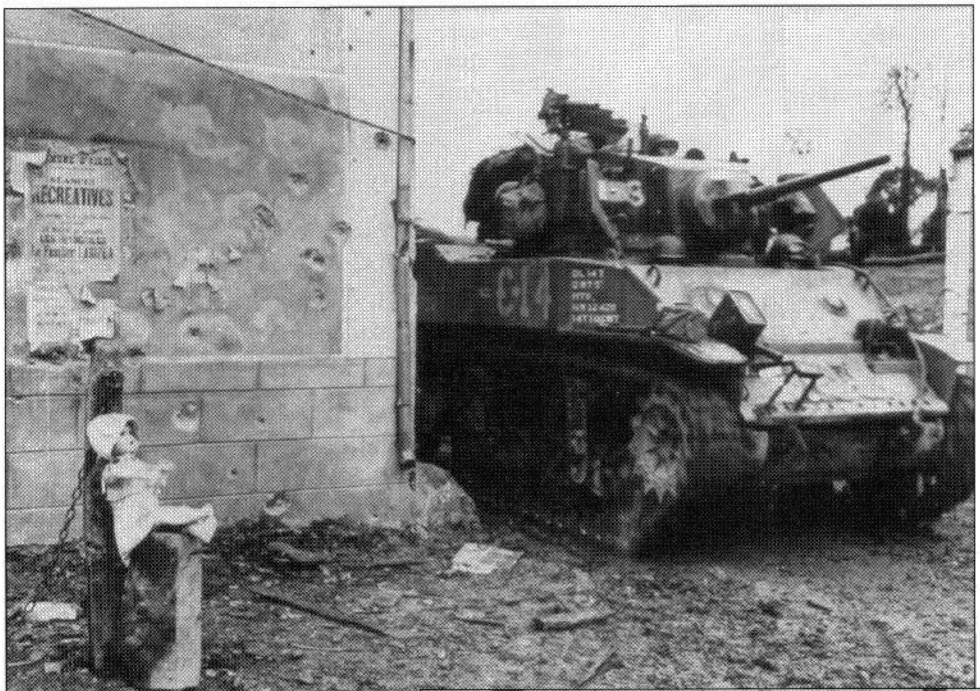
This photo was taken slightly further along the same road as the photo of the M4A1 medium tank near St. Fromond, and shows the knocked out Pz.Kpfw. IV tanks from Das Reich in better detail. Close inspection of the forward tank will reveal a large penetration in the glacis plate, and another on the turret side which led to an internal ammunition fire and explosion which shattered the gun mantlet. To the right of the photo is a M3 half-track personnel carrier from 3rd Armored Div. (US Army)



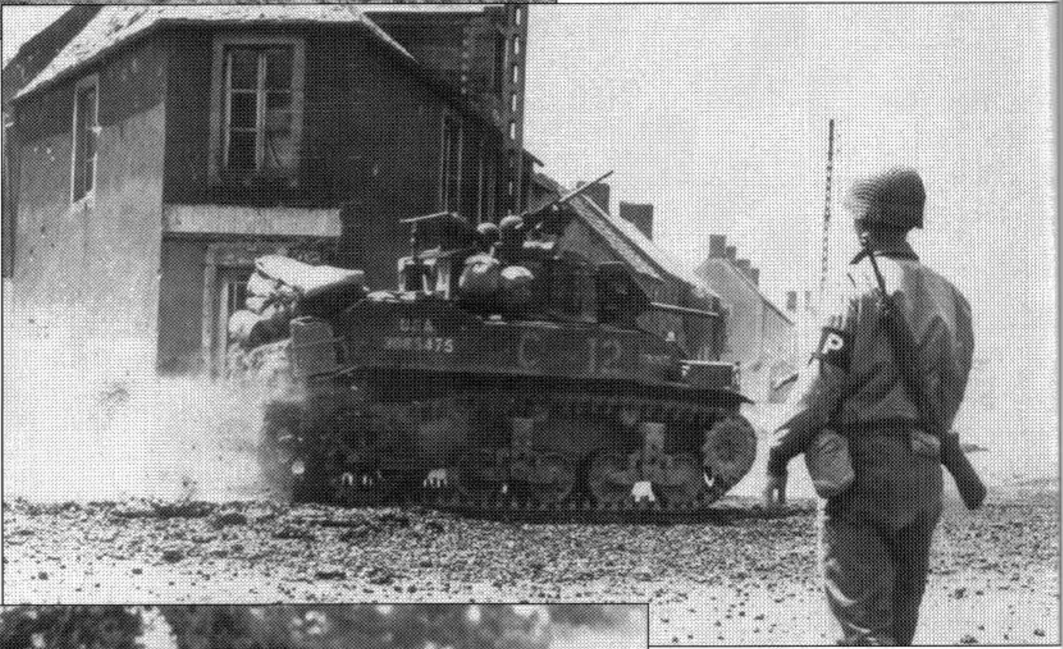
Another view of St. Fromond during the Vire river fighting shows a M5A1 light tank moving past a 90mm anti-aircraft gun on 9 July. The US Army did not regularly use its anti-aircraft guns for anti-tank defense (like the Germans with their 88mm gun), but here it appears that a 90mm is being used to guard a road junction, probably due to the presence of Panther tanks from the 2.SS-Pz.Div. during the fighting that day. (US Army)



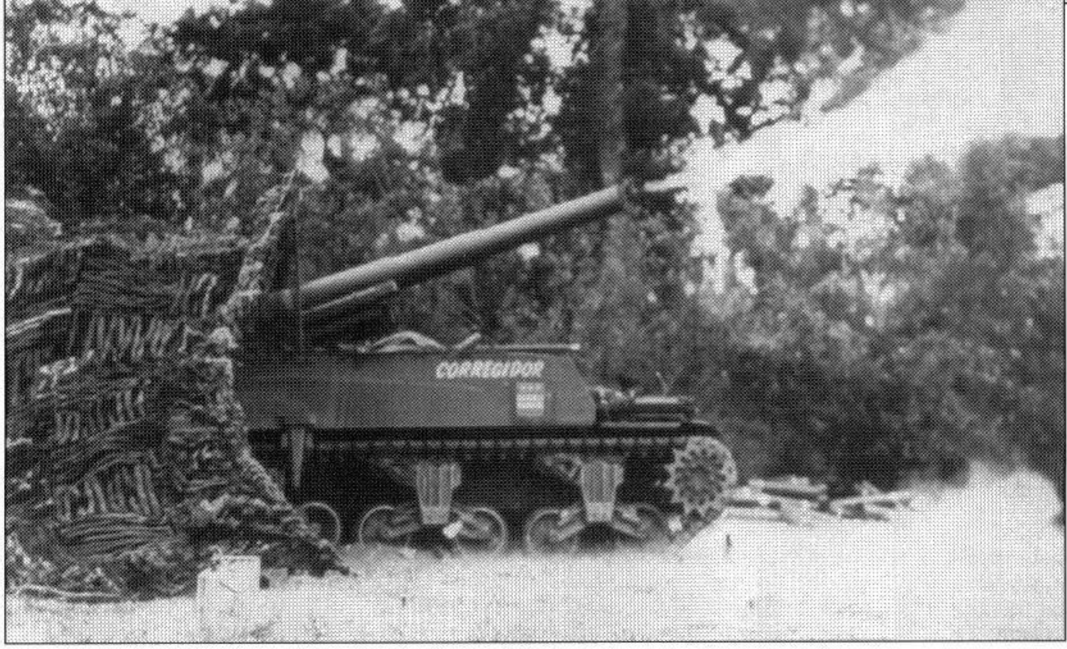
A M4A1 medium tank from 3rd Armored Div. passes along a pair of Pz.Kpfw. IV Ausf J tanks of 2.SS-Pz.Div. knocked out in the Vire river fighting north of St. Lo on 9 July. The side anti-bazooka skirts have been knocked off with only one left dangling on the side, but both tanks retain their foliage camouflage. The presence of Allied fighter bombers made foliage camouflage a daily neccessity for German tankers in the Normandy fighting. (US Army)



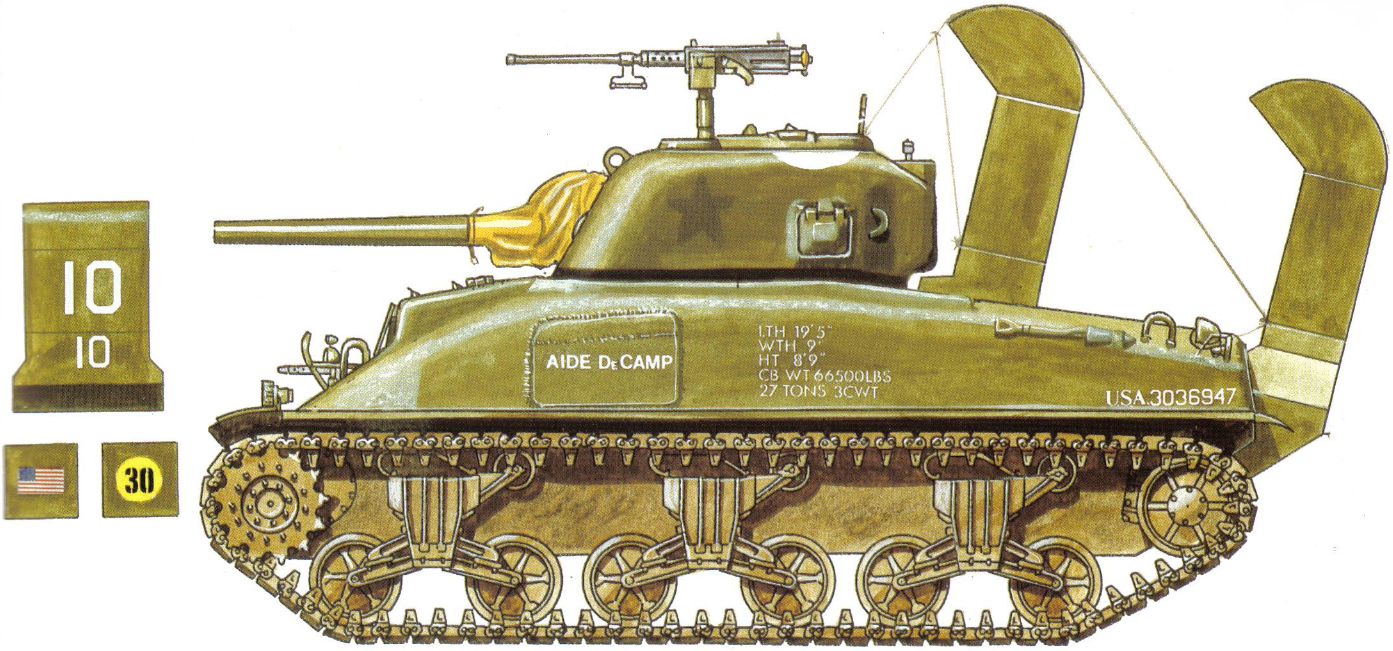
A M5A1 from Co. C, 33rd Arm'd Regt. passes a shell-pocked building in the town of Airel on 11 July, as US armor moved up to stop a German attack from Le Desert against the 9th Infantry Div. One of the curious details on this M5A1 is a device located below the hull machine gun. This is apparently a bullet deflector, added to the tank, which allowed the machine gun to be fired directly below the tank into trenches. (US Army)



An MP directs traffic as a M5A1 light tank of 33rd Arm'd Regt. passes through a town north of St. Lo on 17 July. The fighting in the first two weeks of July pushed the US Army across the base of the Contentin peninsula, and made possible the breakout operation planned for the third week of July.

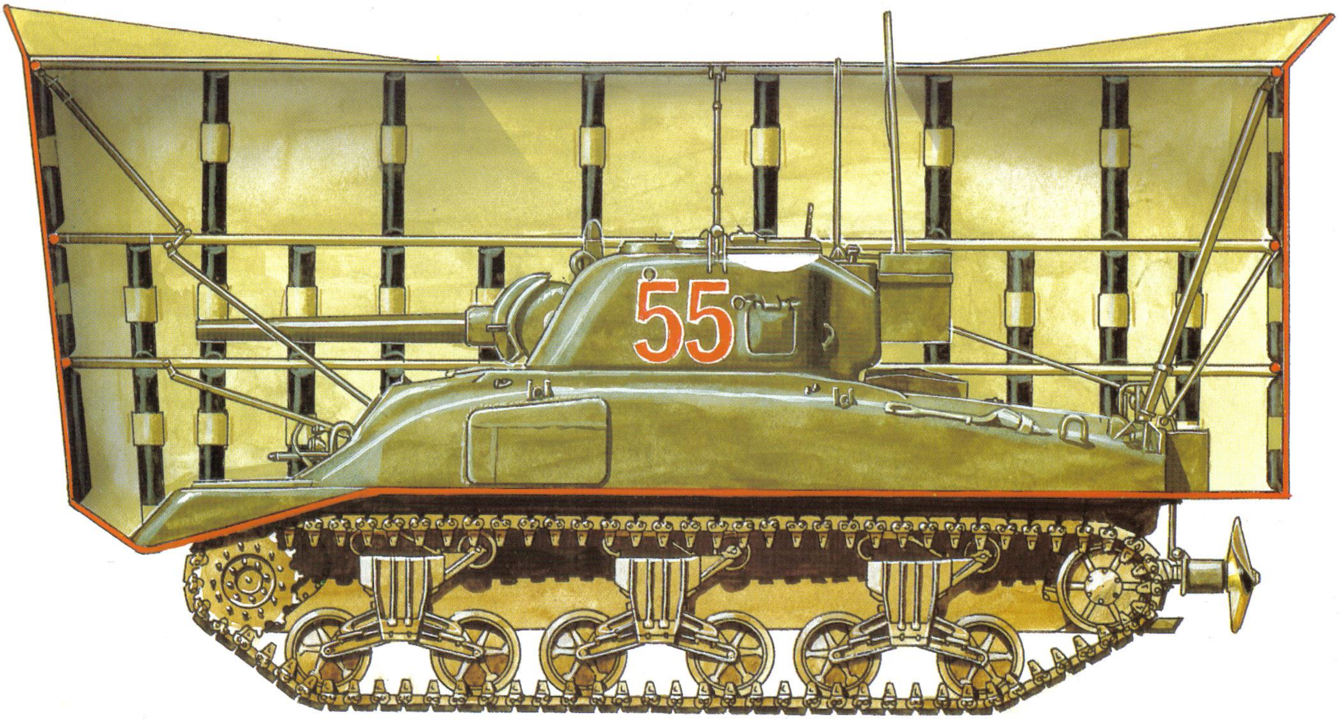


A M12 155mm gun motor carriage named "Corregidor" of the 987th Field Artillery Bn. fires in support of US forces near St. Lo in the Contentin fighting on 16 July. The M12 was a combination of a Sherman chassis with a World War I vintage French 155mm gun. The 987th was the only M12 unit in Normandy until 12 August when it was joined by the 587th and 588th FA Battalions. The M12 was replaced later in the European campaign by the more modern M40 155mm GMC. (The Tank Museum)



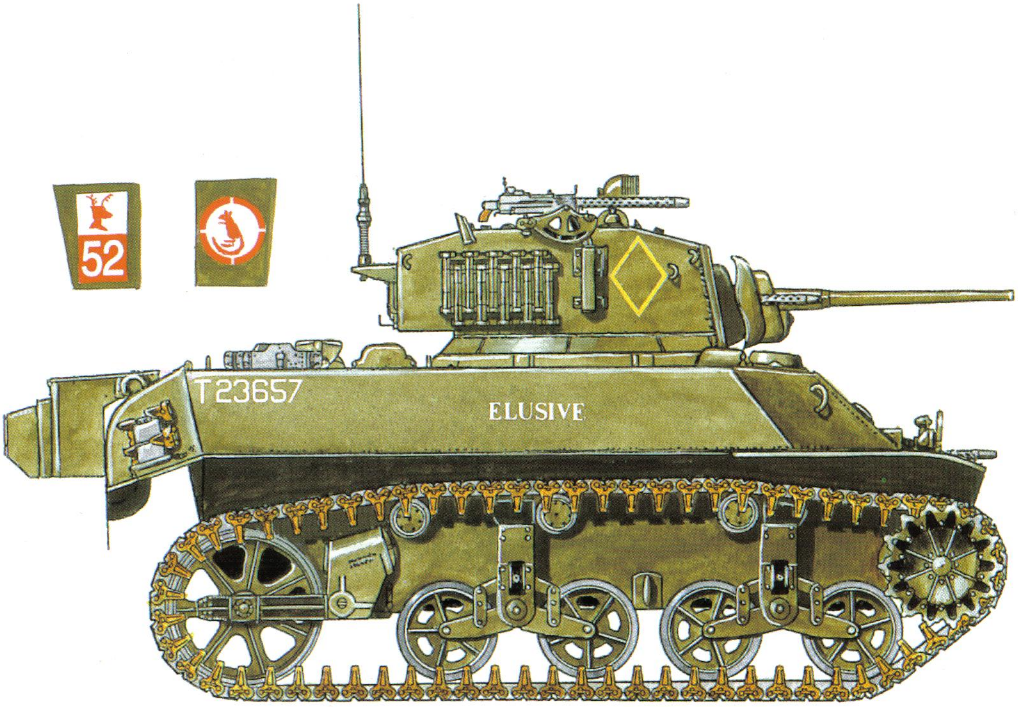
M4A1 Medium Tank, Co. A, 741st Tank Battalion, 16th Infantry, Easy Red/Fox Green, Omaha Beach, Normandy 6 June 1944.

The 741st Tank Battalion was assigned to the 16th Infantry Regiment for the assault on the area between the E-1 and E-3 ravines. Co. A was fitted with deep wading gear, while Co. B and Co. C was equipped with Duplex Drive tanks. During the run-in to the beach starting at 0540, 27 of 32 DD tanks swamped due to the 18 knot wind which whipped up three-to-four foot swells. Only two swam to the Easy Red beach, and three others were landed at the beach by an LCT which could not launch them at sea due to a damaged ramp. These five DD tanks were the first and only assault troops on Omaha Beach for the first half hour. The Co. A tanks were landed at H-Hour (0630) on Easy Red, with two tanks and a dozer tank lost when their LCT was blown up by German artillery. The markings on these tanks were very simple. No bumper were painted on due to security restrictions, nor were there any of the usual white stars. The markings were limited to the tank name, beginning in the company letter, on the hull side (Aide De Camp), the vehicle serial number and a stenciled data plate with shipping information. Some tanks carried a small yellow bridging circle in yellow on the right upper corner of the transmission housing, and a small 12 inch long US flag on the driver's bulge on the glacis plate. Some of the tanks had their vehicle number painted on the rear of the deep wading trunk, in large numbers on the upper portion, and repeated in small fashion on the lower portion of the trunk. The precise nunber of this tank is not known, but two of the tanks that made it ashore were numbered 9 and 10.



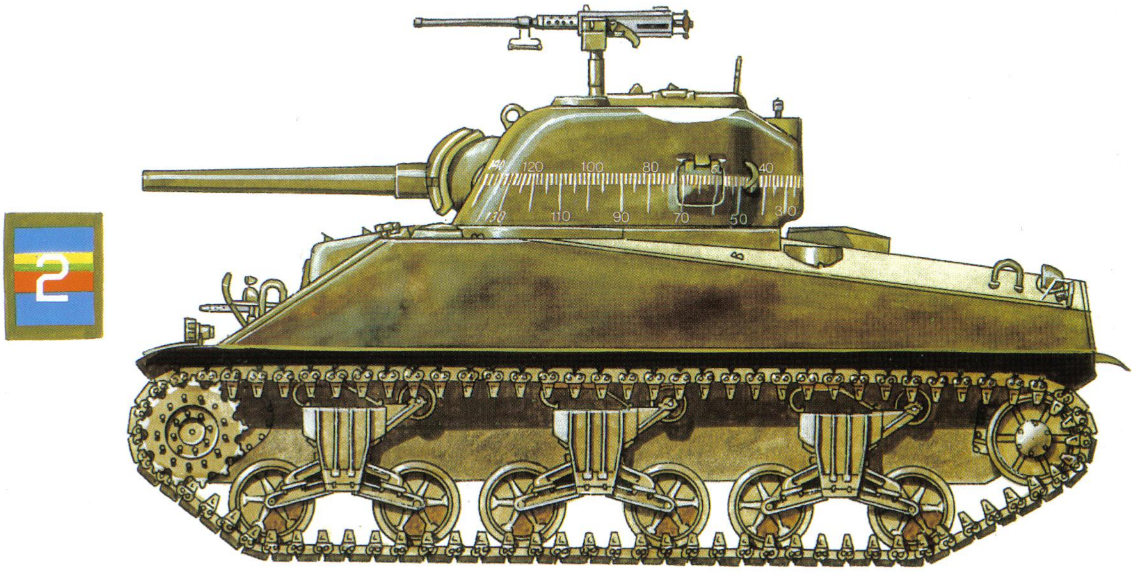
Sherman II Duplex Drive II Amphibious Tank, 13/18th Hussars, Sword Beach, Lion-sur-Mer, Normandy, 6 June 1944.

This cut-away drawing shows the configuration of a Duplex Drive Sherman of the modified type with the extended skirts extensions. The skirt itself was a pale canvas, while the rubber inflatable tubes were left their natural color. The markings are the standard British style, with the tanks numbered sequentially within the regiment. There is a large white ringed Allied star on the turret roof, with part of the circle overlapping the side of the turret. Tanks in this unit were finished in Shade No. 15 olive drab, which replaced Standard Camouflage Colour No. 2 khaki brown in 1944. This color was very similar to US olive drab, and was adopted in part to avoid the need to repaint US Lend Lease vehicles.



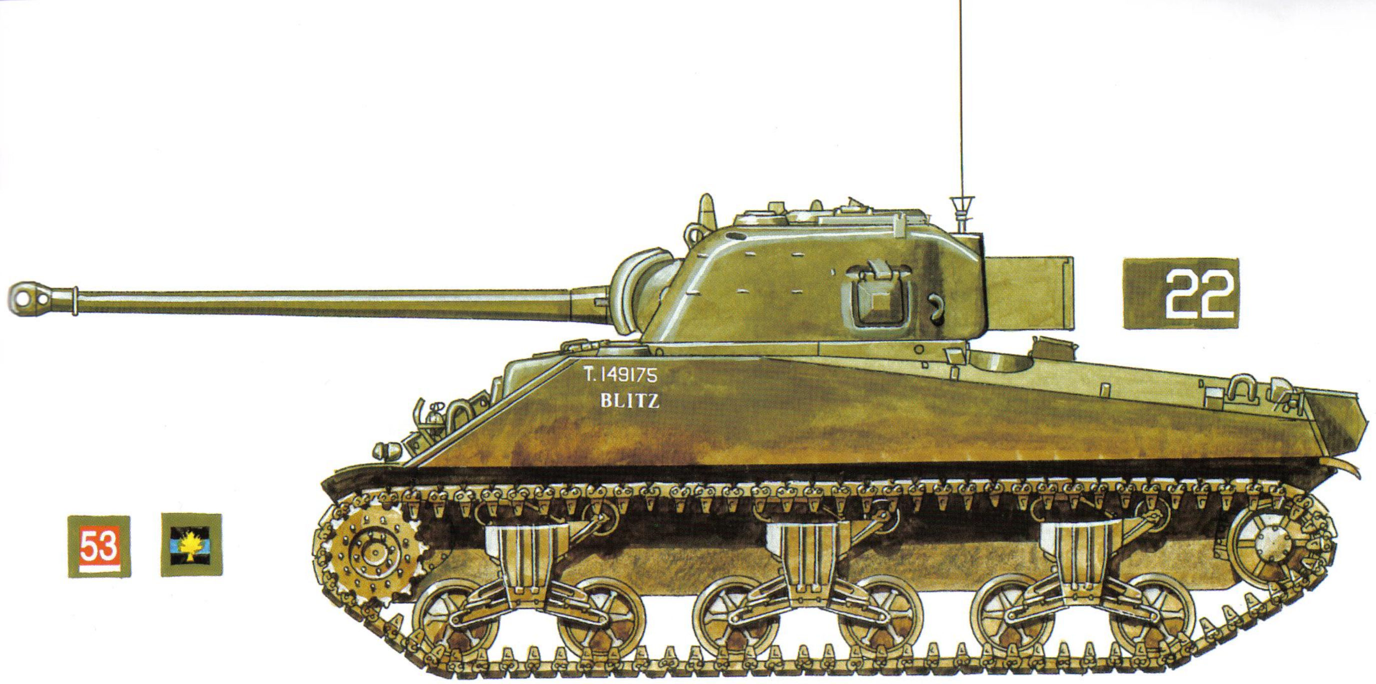
Stuart V (M3A3), 5th RTR, 7th Armoured Div., Gold Beach. Le Hamel, Normandy, 6 June 1944.

This Stuart V carries the full range of standard British markings. On the turret is the squadron insignia, a diamond, indicating a regimental HQ tank. As the second senior regiment in the brigade, the insignia is in yellow, though many regiments simply used white on all their tactical insignia. The 5th RTR traditionally named its tanks beginning in "E", hence, "Elusive". Towards the rear of the hull side is the vehicle serial. The fender markings consist of the 22nd Armoured Bde. marking on right mudguard and the 7th Armoured Div. insignia on the left. The tank is finished in the usual Shade No. 15 olive drab.



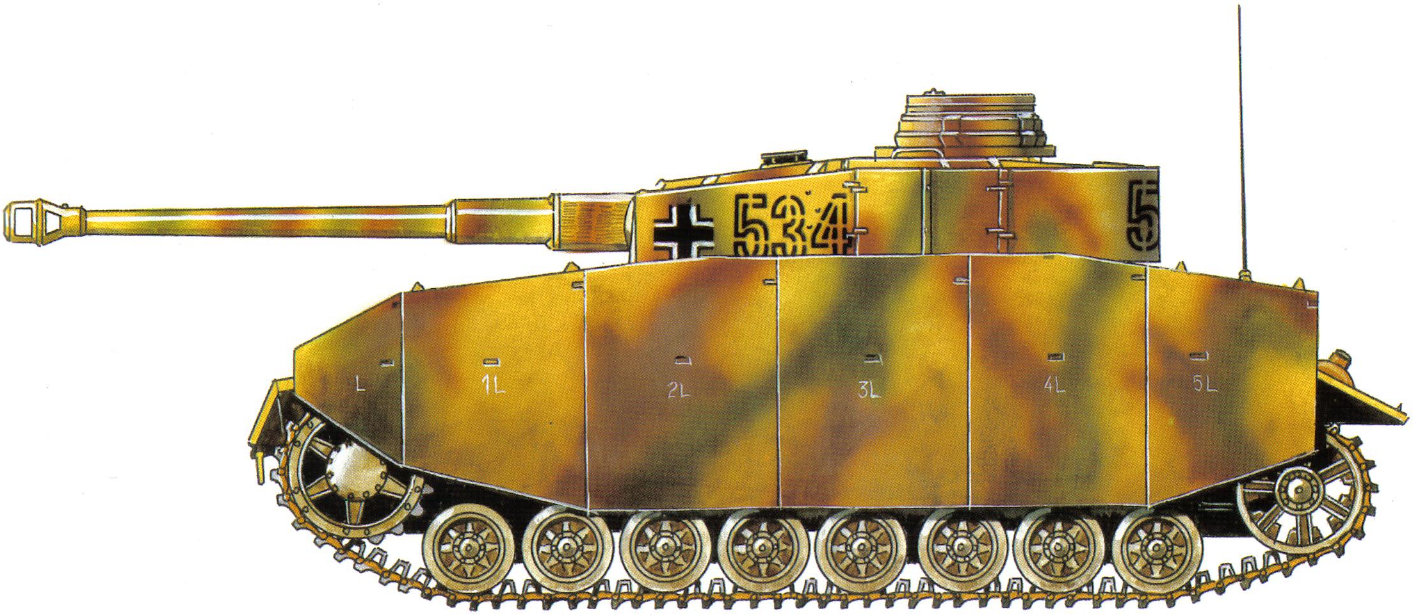
Sherman I, H Troop, 2nd Battery, 1st Royal Marine Armoured Support Regiment, Gold Beach, Normandy, 6 June 1944.

In late 1943, the Royal Marines formed an artillery support regiment based around Centaur IV close support tanks equipped with 95mm howitzers, with Shermans serving as control tanks. The plan was to lash the Centaurs to the decks of LCT (A) landing craft, with the tanks providing close bombardment, with each LCT (A) carrying two Centaur IVs and one Sherman. After the bombarment, the tanks would then land and provide fire support in a more conventional fashion. The unit had bad luck in the Channel crossing as the uparmored LCT (A)s proved unseaworthy and vulnerable to beach obstructions. The Sherman control tanks, like the Centaurs, were painted with traverse graduation markings around the turret to permit fine traversing during the run-in to the beach. The markings of 0/360 degrees began at the centerline of the rear of the turret. Otherwise, the tank was simply marked, carrying the square Royal Marine arm of service marking on the left lower corner of the glacis plate above the stub fender. One of the control Shermans of H Troop was named Fox, the usual location for the name being the lower center of the glacis plate.



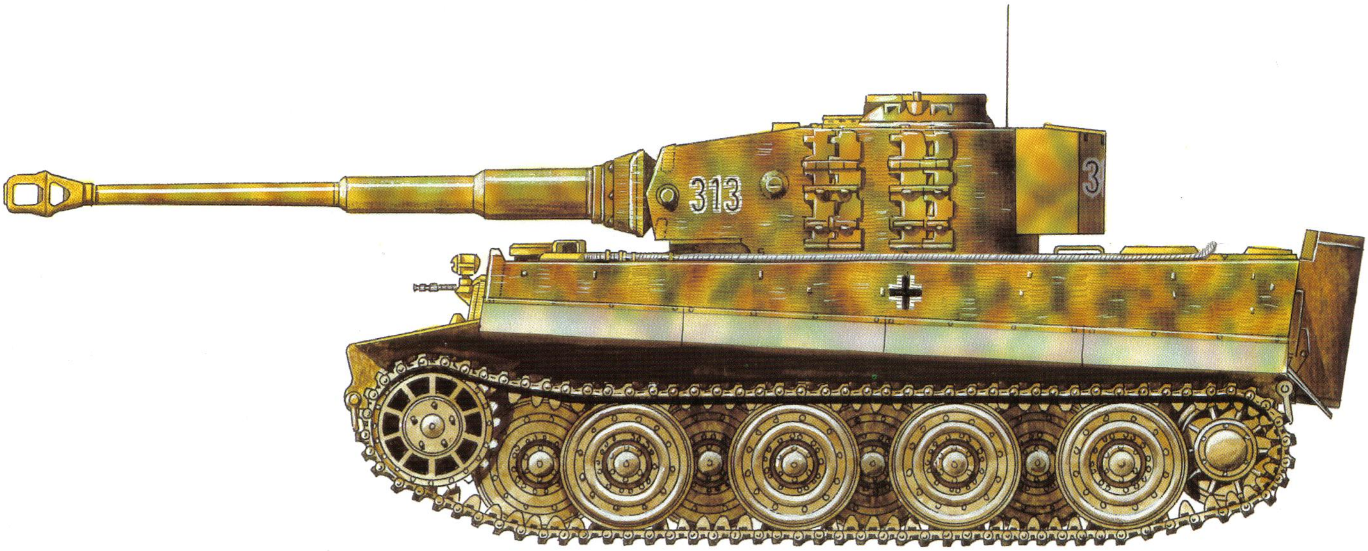
Sherman Vc Firefly, 27th Canadian Armoured Regiment, 2nd Canadian Armoured Brigade, Buron, France, 7 June 1944.

Like most Commonwealth armored units, the Canadian army followed British markings practices. Like many Commonwealth tanks during the initial Normandy operation, this Sherman V of the Sherbrooke Fusiliers (27th Arm'd Regt.) is very plainly marked. At this stage of the war, no effort was being made to conceal the Fireflies by disruptive barrel painting as would occur later in the summer. The vehicle name is Blitz, and the tank carries the usual vehicle serial number on the hull side. The vehicle tactical number, 22, is carried on the right side of the rear turret radio box. The formation sign for the regiment was a white 53 on a red square over a white band, carried in the usual fashion on left side of the rear hull plate and on the glacis plate above the right stub fender. The 2nd Canadian Armoured Brigade insignia, a gold maple leaf on a black square with blue stripe, was carried opposite to the regimental insignia (right rear of the hull plate, on the glacis plate above the left stub bumper). The tank is finished overall in Shade No. 15 olive drab. This particular tank was one of those knocked out on 7 June 1944 while supporting the 9th Canadian Infantry Brigade near Buron. The Canadians were counterattacked by Pz.Kpfw. IVs of the 5th and 6th companies of SS-Pz.Rgt. 12 of the SS-Pz. Div. Hitlerjugend. The Canadians lost 28 tanks in the battle, the Germans lost 6.



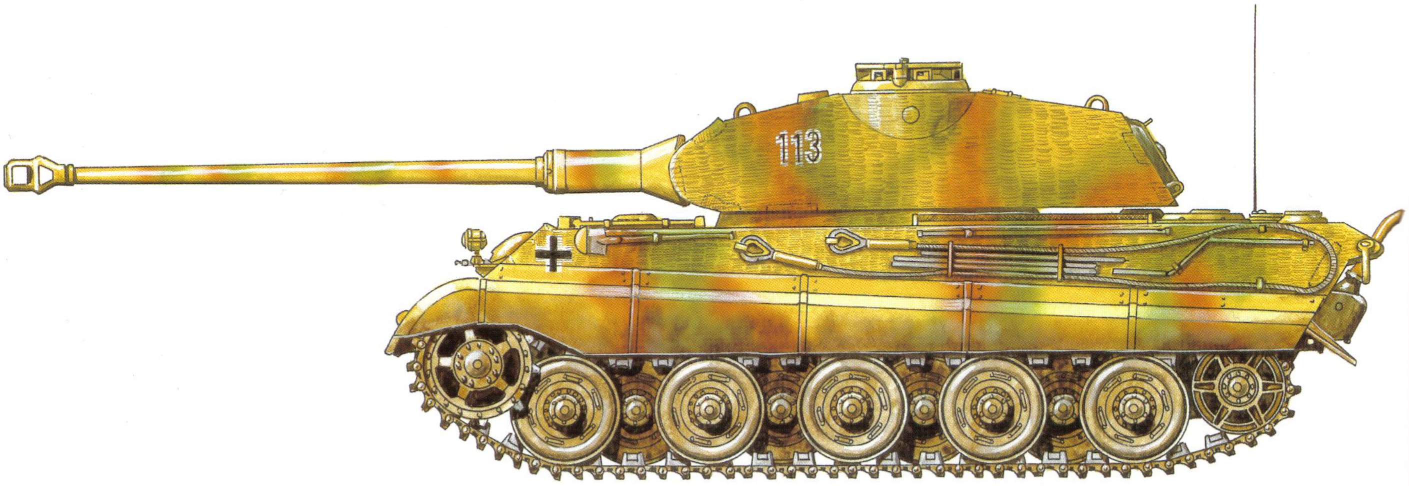
Pz.Kpfw. IV Ausf. H, 5./SS-Pz.Rgt. 12, SS-Panzer Division Hitlerjugend, Buron-Authie, 7 June 1944.

The tanks of SS-Pz. Rgt. 12 were marked with an unusually drab stencilled tactical number in black instead of the usual white with no fill-in color. The vehicle tactical markings follow the usual German practice and indicate a tank of the 5th company, 3rd platoon that was involved in the fighting with the Canadians around Buron on D-Day+1. The regiment painted the markings in silhouette form only as was common in Normandy in 1944. It is finished in the usual German scheme of RAL 7028 dark yellow with spray painted patterns of RAL 6003 olive green and RAL 8017 red brown.



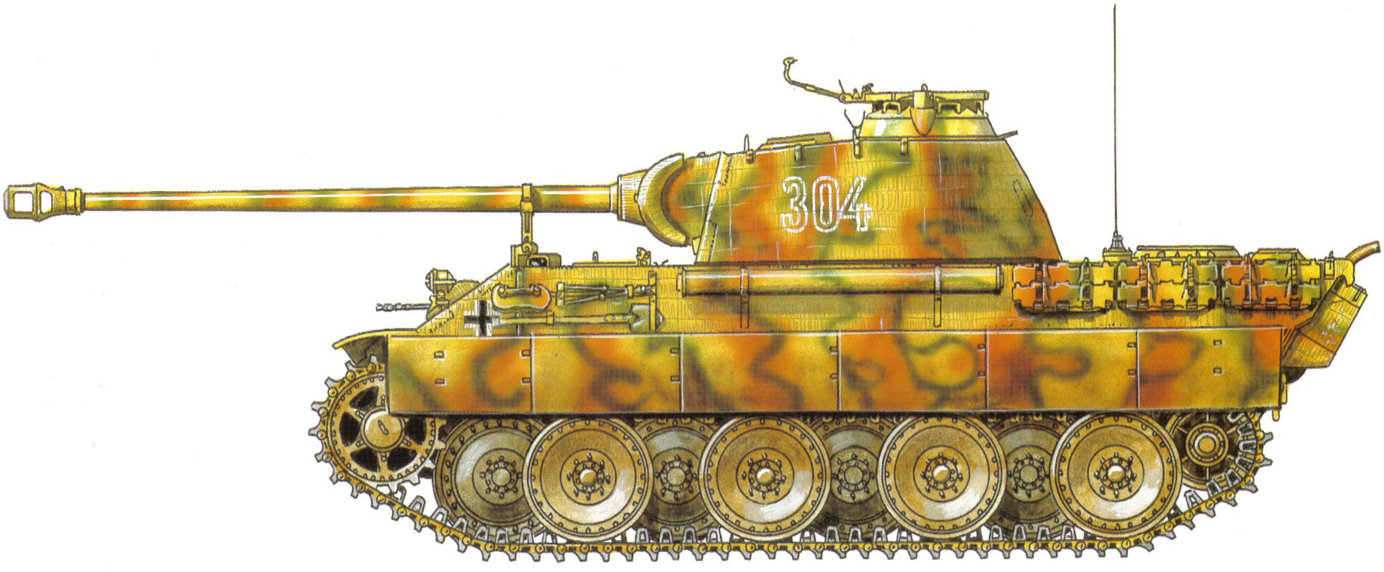
Tiger I Ausf. E, s.Pz.Abt. 503, Colombelles, France, 11 July 1944.

This Tiger heavy tank unit was equipped with 12 Koenigstigers in the 1st company and 33 Tiger Is in the 1st and 2nd companies when it arrived in France in early July. It was committed to action in a counter-attack near Colombelles on 11 July 1944 while attached to 21. Panzer Division. This particular tank, commanded by Feldwebel Sachs, was credited with knocking out 11 British Shermans and 5 anti-tank guns during the fighting. The Tiger is painted in the standard German tank scheme of RAL 7028 dark yellow with spray painted patterns of RAL 6003 olive green and RAL 8017 red brown, but the colors have been heavily thinned, resulting in a faint pattern. The tactical numbers identify it as a tank of 3rd company, 1st platoon, 3rd vehicle; the only anomoly is that Sachs, being the platoon leader, should have had a tank numbered 311. This shows that the tactical numbering system was not always followed, as some unit leaders would take tanks from other crews if their own tanks were being repaired. This tank was blown upside down by a bomb during the heavy aerial bombardment that preceded Operation Goodwood on 18 July 1944 near the Chateau de Manneville.

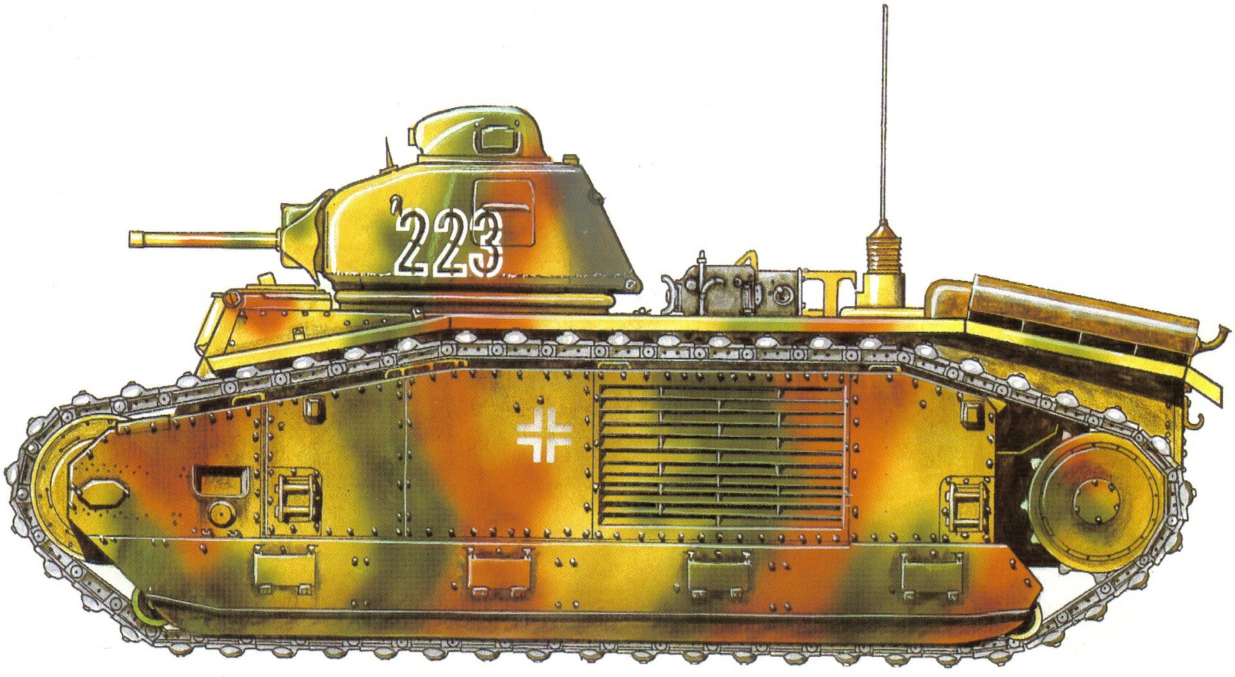


Pz.Kpfw. VI Ausf. B Koenigstiger, s.Pz.Abt. 503, Normandy, France, July 1944.

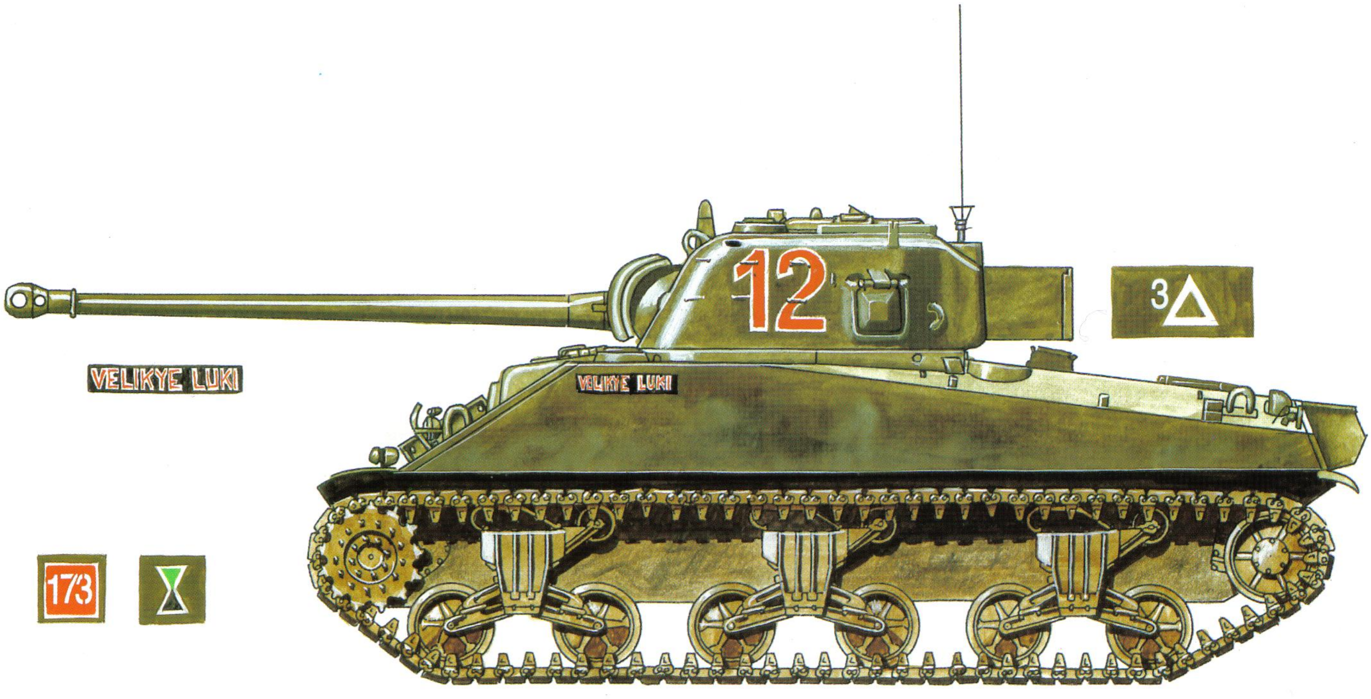
This Tiger heavy tank unit was partially equipped with 12 Koenigstigers in the 1st company at the outset of the campaign (and 33 Tiger Is). It was the only Tiger II unit in service in Normandy. There were 41 Tigers in service when the unit reached combat on 11 July, and by 6 August, the unit had been reduced to 11 tanks due to the fighting. The 3rd company was reequipped with 14 Koenigstigers by August. The vehicles in service with the 1st company as seen here had a typical finish of RAL 7028 dark yellow with spray painted patterns of RAL 6003 olive green and RAL 8017 red brown, with tactical numbers applied on the forward half of the turret, and sometimes repeated on the rear turret hatch.



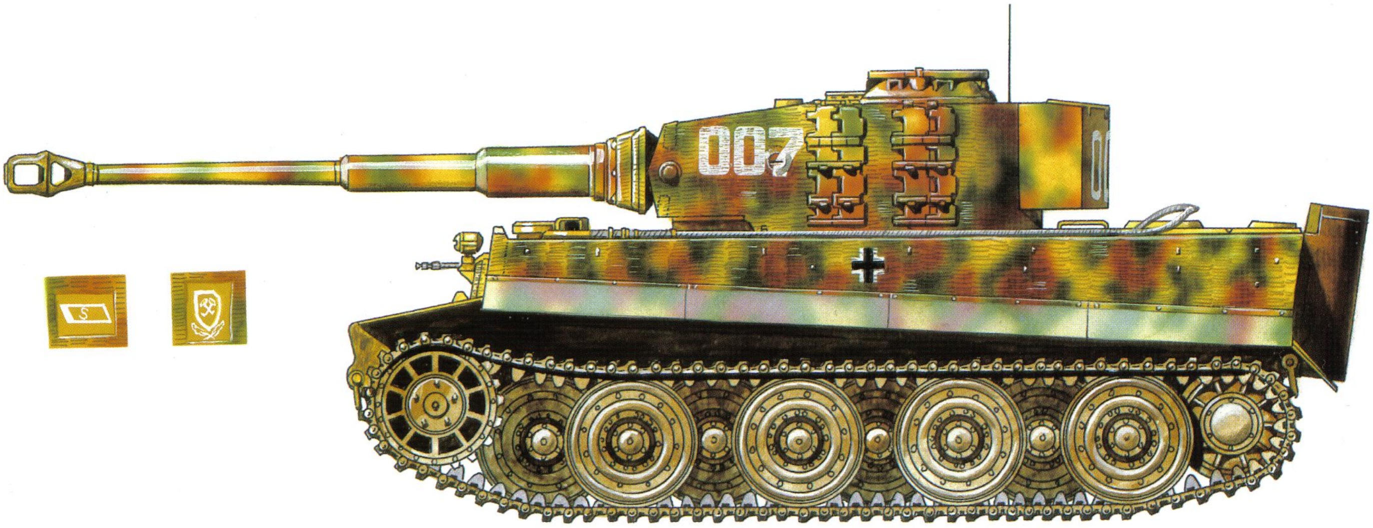
Pz.Kpfw. V Panther Ausf. A, 3./SS-Pz.Rgt. 12, 12.SS-Pz.Div. Hitlerjugend, June 1944.
This was the tank of Obersturmbahnfuhrer Rudolf von Ribbentrop, the commander of the third company of SS-Pz.Rgt. 12. It is finished in the usual German scheme of RAL 7028 dark yellow with spray painted patterns of RAL 6003 olive green and RAL 8017 red brown, with the overpainted camouflage being diffuse and more squiggly than normal. This was due to the practice of having the units paint the tanks themselves, leading to considerable variation in the appearance of the camouflage patterns, even within a single unit. The tactical number is a stencilled white outline, without any fill-in color being added. Once again, the number does not follow standard numbering practices for a unit commander.



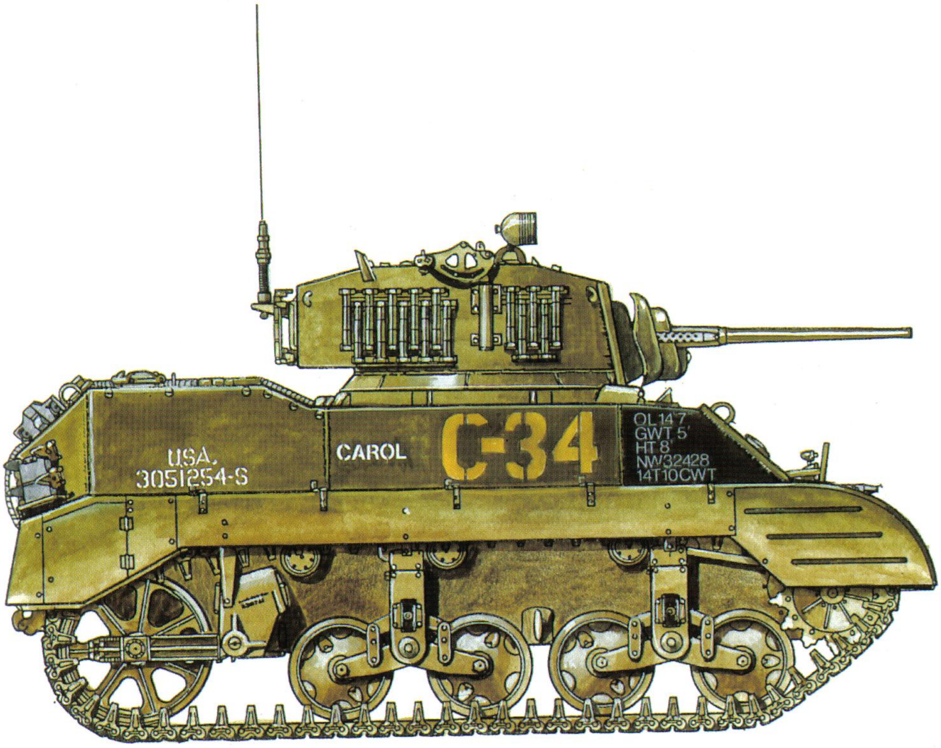
Pz.Kpfw. Renault B1 bis 740(f), Panzer Abteilung 213, Jersey, Channel Islands, August 1944.
German units in occupied Europe made extensive use of captured French armor for training and in active service. A unique example was Pz. Abt. 213, the only German tank unit stationed on occupied British soil in World War 2. The battalion was deployed to the Channel Islands with 36 Char B1 bis in 1942 to resist an Allied landing; in the event, the Normandy invasion bypassed the islands, and the garrison finally surrendered in 1945. This Char B1 bis is painted in the standard German vehicle camouflage adopted in May 1943 consisting of RAL 7028 dark yellow with spray painted patterns of RAL 6003 olive green and RAL 8017 red brown. These vehicles were marked in the usual fashion, with the first number indicating company, the second indicating platoon and the final number indicating the individual vehicle. Other units in western Europe were also equipped with the Char B1 bis, including a company from Pz.Abt. 223, (Pz.Kp.224) in the Netherlands, and two companies of Pz.Rgt. 100 in France. Pz.Abt. 100, a replacement and training unit, was disbanded prior to the Normandy fighting. Pz. Abt. 206 had 5 Char B1 bis tanks along with 28 Hotchkiss 38H light tanks, 10 Somua 35.S cavalry tanks and 2 Hotchkiss 38H converted to driver trainers. The unit was wiped out in fighting in the Cherbourg peninsula.There are few records of combat between such units and the Allied forces, but Allied forces did capture several Char B1 bis tanks.

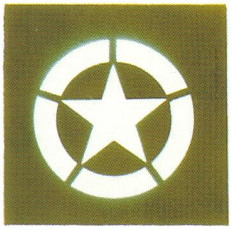


Sherman Vc Firefly, 3 Troop, A Sqd., Northamptonshire Yeomanry, St. Aignan de Cramesnil, France, 8 August 1944.
This is the Sherman Firefly commanded by Sgt. Gordon that knocked out the Tiger I tank of Michael Wittmann and two other Tigers during the fighting at St. Aignan on 8 August. "A" Squadron vehicles were marked consecutively with the 3 Troop numbers being 9 through 12. The unit was also identified by the standard squadron tactical sign, (A Sqd: triangle; B Sqd: Square; C Sqd: Circle), on the rear of the turret radio box, preceded by the troop number (3). Markings on the bow consisted of the brigade sign, a green/black diablo on the left side front below the headlight, and the regimental number, a white 173 on a red square trimmed in white, on the right side. The Northamptonshire Yeomanry had the practice of naming the tanks in their unit in a consistent fashion between Squadrons. "A" Squadron used Russian city names, with 3 Troop using names starting with V (Vostock, Vladivostok, Vitebsk and Velikye Luki). It appears that the troop Firefly was "Velikye Luki", the double name selected to reflect the long-barrel 17 pdr. The name was in red with white trim.

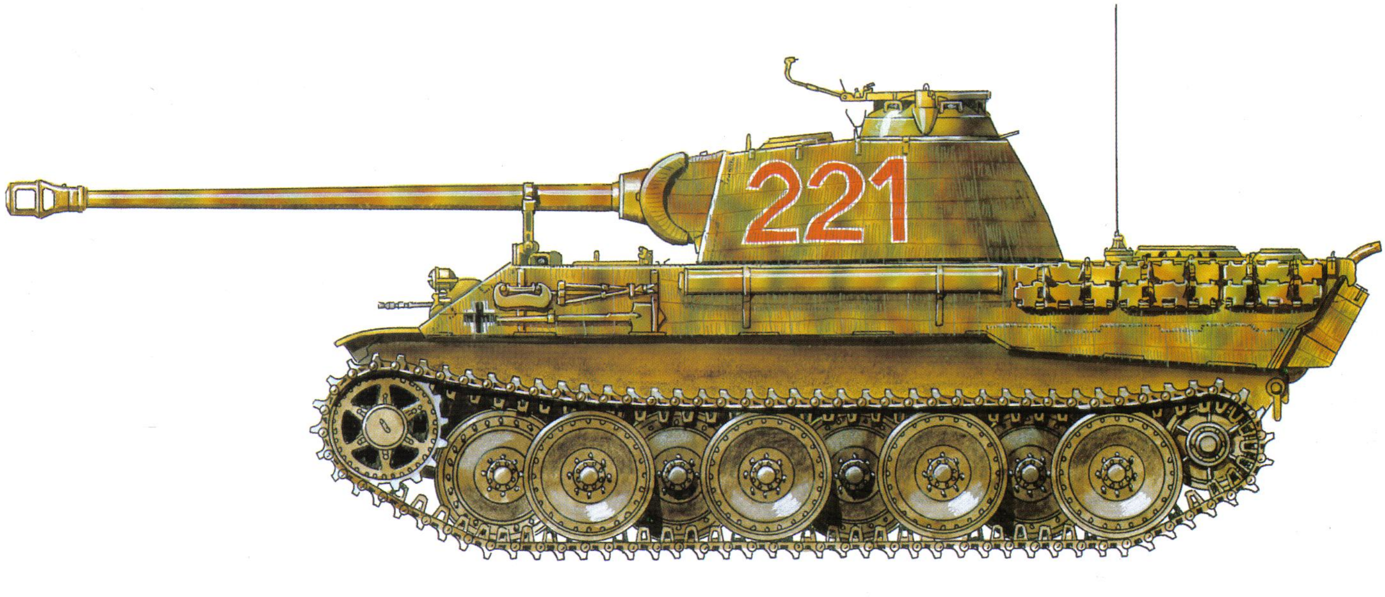


Tiger I, s.SS-Pz. Abt. 101, St. Aignan de Cramesnil, France, 8 August 1944.
This was the tank commanded by the well-known tank ace, Michael Wittmann, when he was killed in action on 8 August 1944. There was some controversy about the specific identity of his tank during the battle, the presumption being that he would have been operating a tank marked with a command tactical number. Recent research indicates that this was the tank he was using, presumably having "borrowed" it from another crew. But as noted in several of the color plates here, many unit commanders did not follow the standard numbering practice. This battalion had a nominal strength of 45 Tiger Is, but 37 were in service at the outset of the campaign. Wittmann lost one of these during his rampage through British armored columns at Villers Bocage. The markings on this tank are fairly straightforward, one of the few unusual features being the use of a solid white tactical number instead of the more common stencilled outline form so common in Normandy. The I.SS-Panzer Corps insignia was carried on the upper left corner of the glacis plate outboard the driver's visor on a square patch cleared of *zimmerit*, and on the opposite side was the standard tactical symbol for a heavy tank battalion.

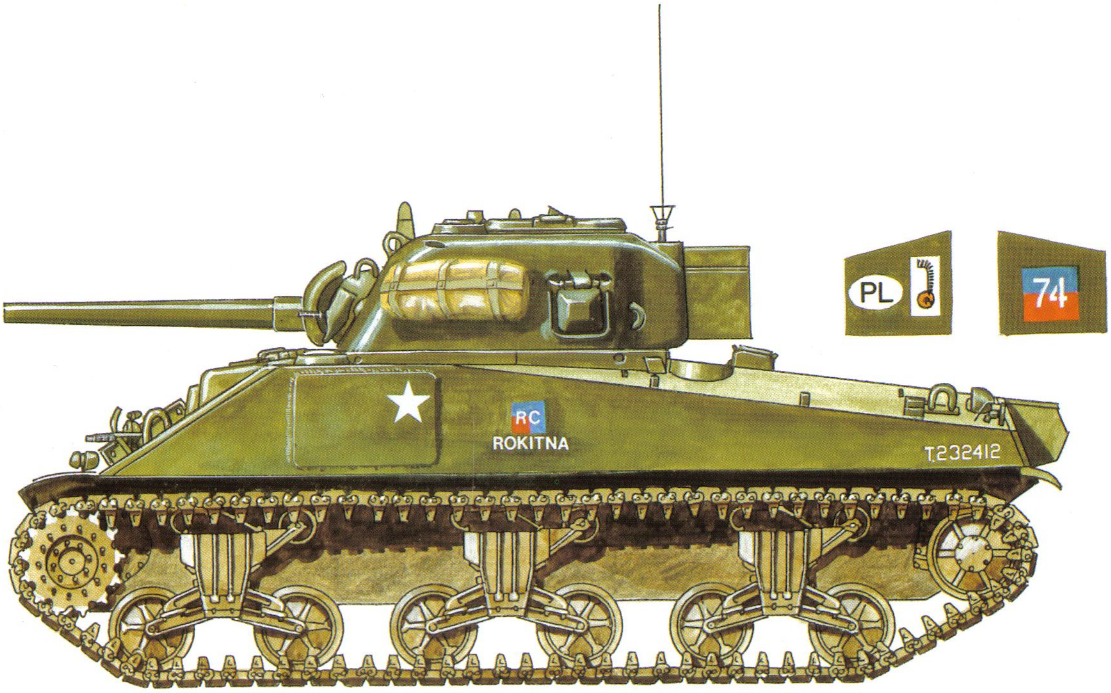




M5A1 Light Tank, Co. C, 33rd Tank Bn., 3rd Armored Div., Operation Cobra, St. Lo, France, July 1944.
This M5A1 shows US Army markings typical of both 2nd and 3rd Armored Divs. during the first month of the fighting in Normandy. Both divisions painted a standard tactical marking in yellow on the turret side (on M4 medium tanks) or the hull side on the smaller M5A1 light tanks. This consisted of the company letter and a one or two digit number. Other markings include a vehicle name starting in the company letter, some samples from this unit being Concrete (C-12) and Carol (C-34). On the forward superstructure side is a data table used for shipping purposes. During the Normandy campaign, the white star was carried only on the turret roof and engine deck.

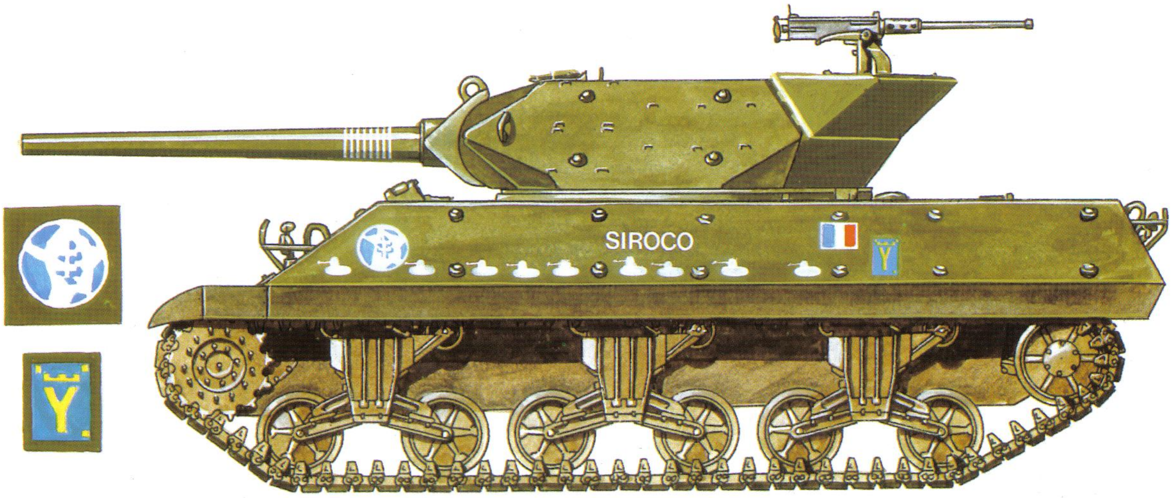


Panther Ausf. A, Panzer Lehr Regt., Panzer Lehr Div., St. Lo, August 1944.
The Panther tanks of the Panzer Lehr Division were distinctive due to their unusually large turret numbers in red with white trim. In other respects, the tank was finished in the usual German scheme of RAL 7028 dark yellow with spray painted patterns of RAL 6003 olive green and RAL 8017 red brown, with the overpainted camouflage being diffuse. Because each unit mixed its own paint, the amount of pigment added to the color paste varied enormously. Panzer Lehr tanks seem to have been painted with heavily thinned paint which left a very indistinct pattern.



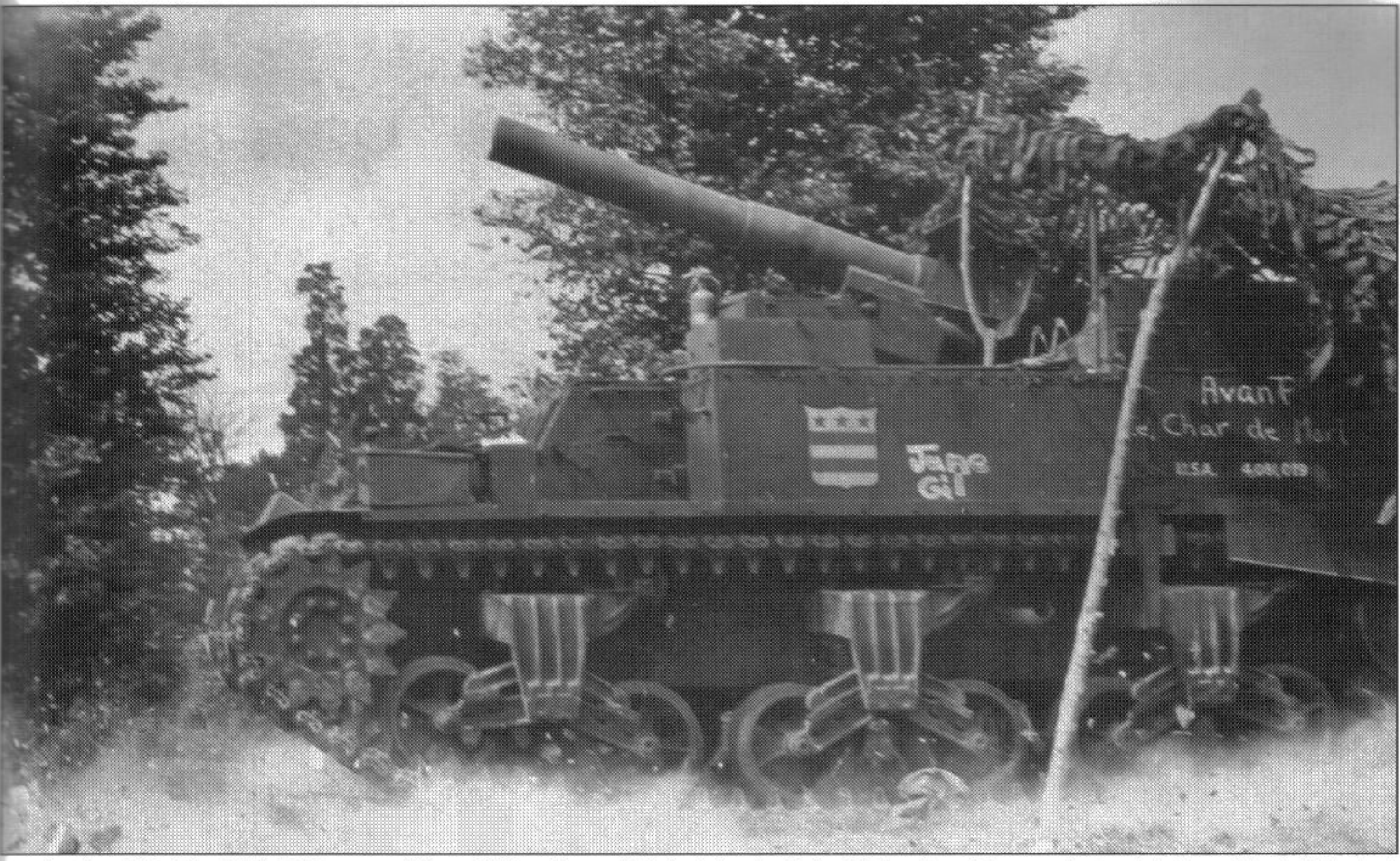
Sherman V, 1st Motorized Artillery Regiment, Polish 1st Armoured Division, Falaise Gap, August 1944.

The Polish 1st Armoured Division followed standard British marking practices and is painted overall in Shade No. 15 olive drab. This Sherman V is the C Troop commander, evident from the tactical sign on the hull side, the rest of the vehicles in the Troop were Sexton 25 pdr. self-propelled howitzers. The tactical markings consisted of the usual blue and red artillery square with the red square in the upper right corner indicating 1st Battery, in the lower right indicating 2nd Battery, and in the lower left corner, indicating 3rd Battery. The troop commander's used a two letter code beginning with R and followed by the Troop letter; gun position officers used a code beginning in G, followed by the Troop letter, Sextons were marked by the vehicle number or letter followed by the troop letter. The regimental formation sign was a red and blue square with white "74" code, and was carried on the far right side of the rear hull stowage box, and on the left upper corner of the bow transmission housing. On the far left corner of the hull rear was the divisional insignia (a stylized winged hussar in the Polish armored force colors of orange and black) and the Polish automobile sign, a white oval with PL. The divisional insignia was also often carried on the right upper corner of the transmission housing, opposite the regimental formation sign. The tank is named *Rokitna*, a reference to the September 1915 battle by the Polish Legion of the Austro-Hungarian Army where the regiment's lineal ancestor, the 1st Legion Field Artillery Regiment, fought with distinction against the Czarist Army.

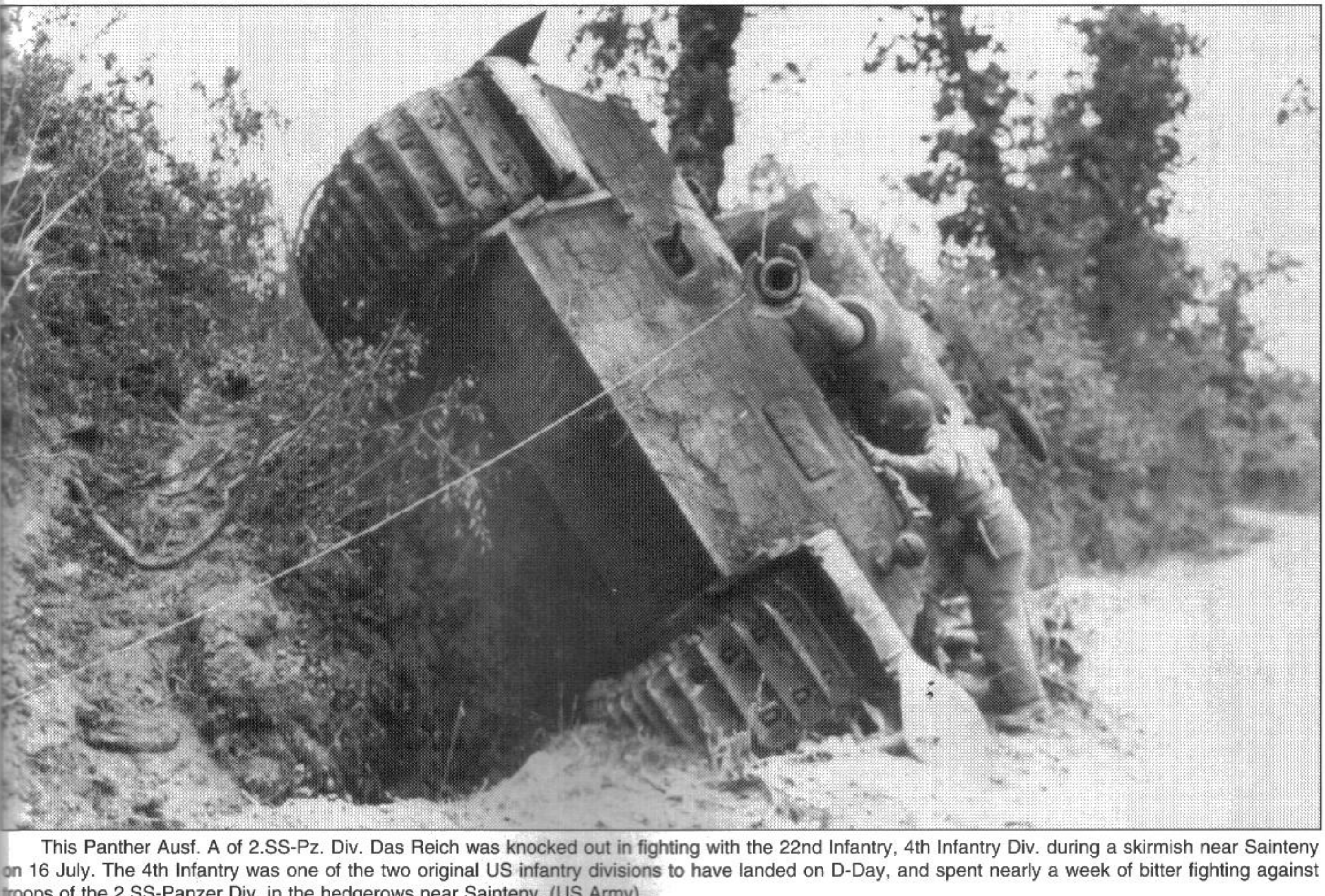


M10 Tank Destroyer, 3rd Platoon, 4th Squadron, RBFM, French 2e Division Blindee, Paris, August 1944.

The *Regiment Blindee de Fusiliers Marins* (RBFM: Armored Regiment of the Naval Riflemen) was one of the most colorful units of the French 2nd Armored Division (2e DB). It was formed from the *Batalion de Fusiliers Marins de Bizerte* in Tunisia in 1943 and was made up of sailors who volunteered to serve in the Free French army due to a shortage of manpower. The unit retained portions of the naval uniform, even after it had been converted to a tank destroyer unit for the 1944 campaign. The markings followed the usual practices of the 2e DB. All unit vehicles were painted with the blue and white map of France insignia. A complicated set of unit markings was devised, painted on a blue square. The letter, in ths case Y, indicated the regiment. The horizontal bar indicated the squadron, with the number of vertical pips indicating the squadron number. The platoon was indicated by the small squares above and below the squadron line, one in the upper left being 1st, two in the upper left and right being 2nd and two in the upper left and right and a third in the lower right being 3rd platoon. Some vehicles had white bands painted, German fashion, around the gun barrel for German tanks detroyed, and Siroco here added small silhouettes on the hull side as well. These kill markings were added after the 1944 Paris fighting. The vehicle names in the RBFM were taken from French warships. Siroco (serial 420154) was the most famous M10 of the unit, having won a duel with a German Panther tank on the Place de la Concorde plaza in the center of Paris on 25 August 1944.

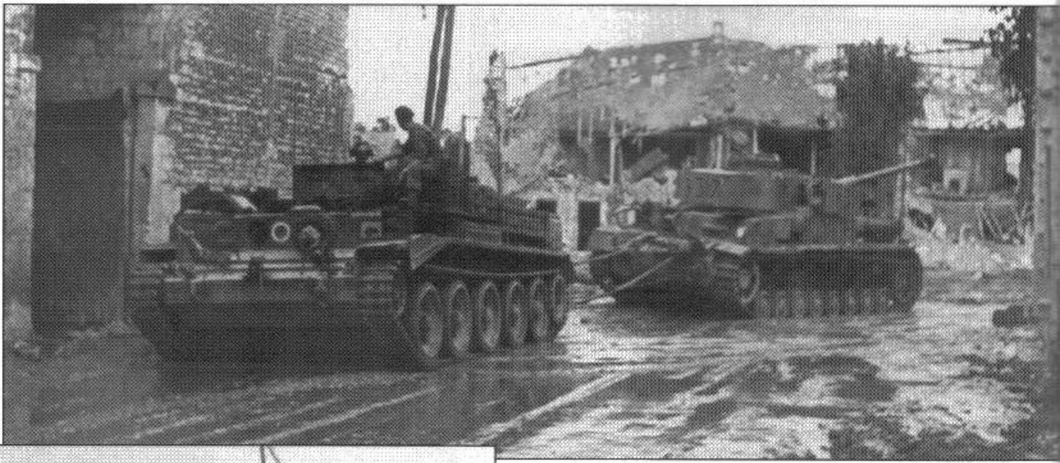


Another M12 of the 987th FA Bn. named "June Gil" in action on 16 July during the St. Lo fighting. It would appear that each battery of the battalion had a slightly different shield design on the hull side. The French inscription on the hull side: "Avant le char de mort!" means "Forward tank of death!".

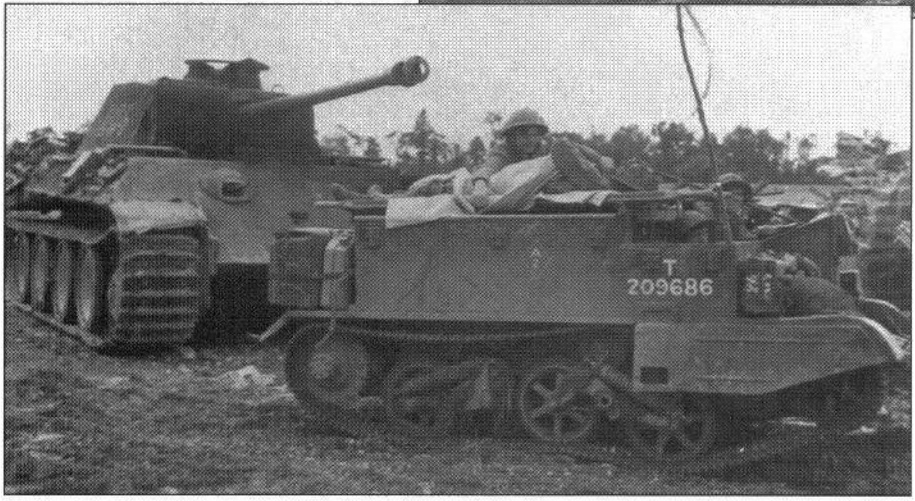


This Panther Ausf. A of 2.SS-Pz. Div. Das Reich was knocked out in fighting with the 22nd Infantry, 4th Infantry Div. during a skirmish near Sainteny on 16 July. The 4th Infantry was one of the two original US infantry divisions to have landed on D-Day, and spent nearly a week of bitter fighting against troops of the 2.SS-Panzer Div. in the hedgerows near Sainteny. (US Army)

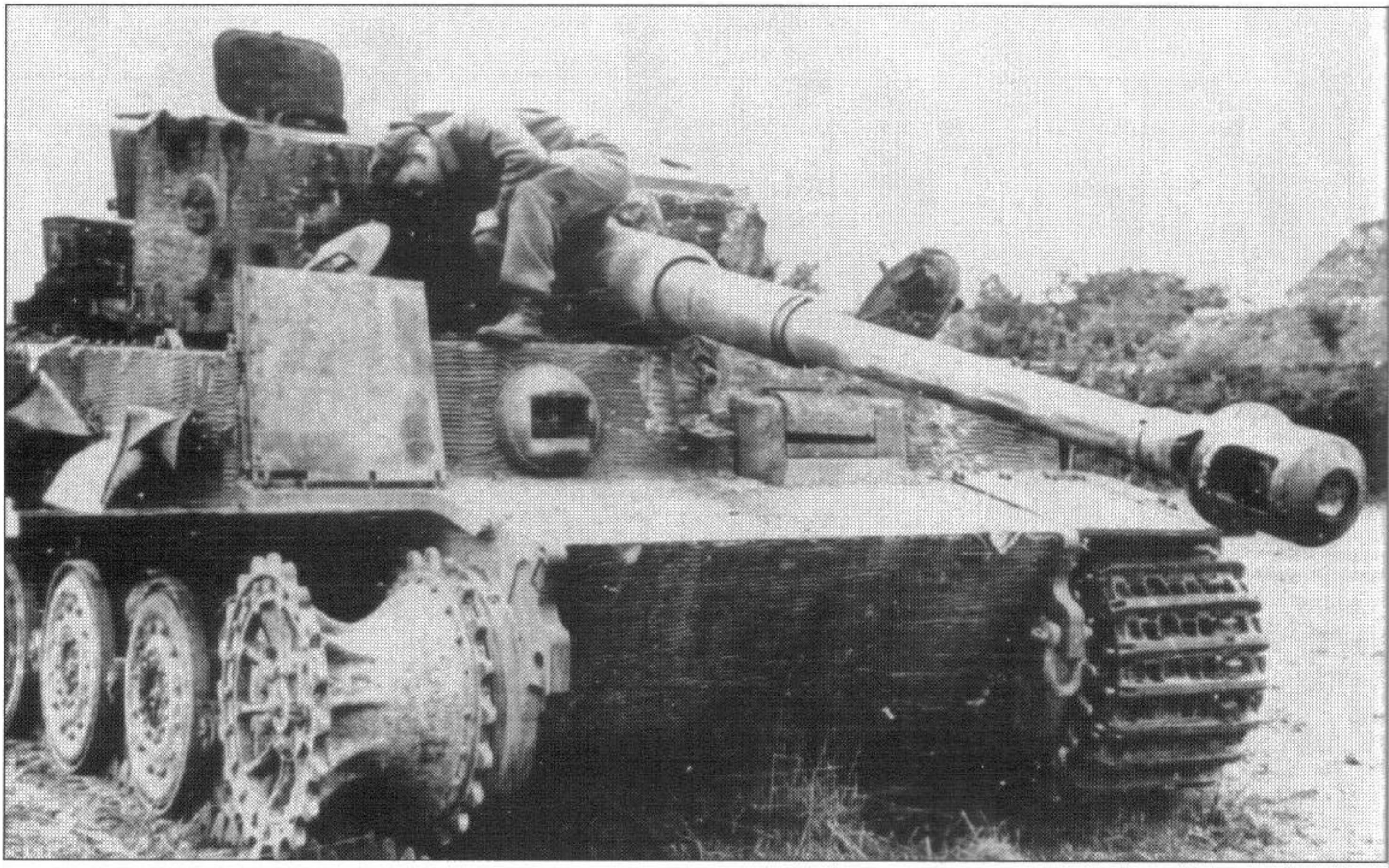
The Caen Fighting



A Centaur ARV of the British 11th Armoured Div. recovers a German Pz.Kpfw. IV near Caen on 9 July 1944 shortly after northern portions of the city had been taken. The divisional insignia, a rampant bull, is evident on the glacis plate. The Centaur, which preceded the better powered Cromwell, was later used for specialized roles such as armored vehicle recovery. (The Tank Museum)

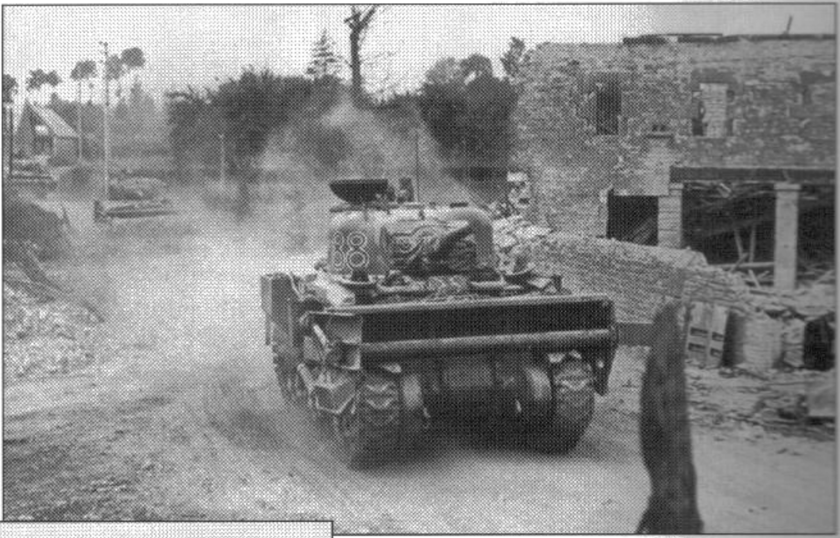


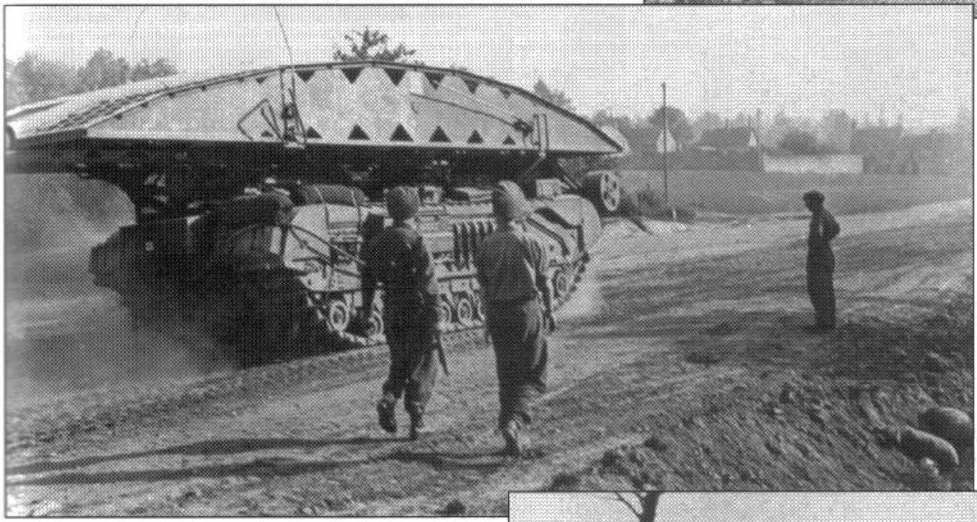
A Universal Carrier being used as an ambulance by the Durham Light Infantry passes by a knocked out Panther Ausf. A near the junction of routes D139 and 173a. This was one of the Panthers of 12.SS-Pz.Div. (Hitlerjugend) which was knocked out by a hit on the left rear side which set its fuel on fire during fighting in late June with the Canadians. (The Tank Museum)



A Tiger I is inspected near Caen by a British soldier. The Tiger was the most deadly nemesis of British armor in the Caen fighting, and both German heavy tank battalions operated in the British and Canadian sectors, most memorably around Hill 112. This is a late production type with steel-rimmed road wheels, and has obviously suffered an internal ammunition explosion. (The Tank Museum)

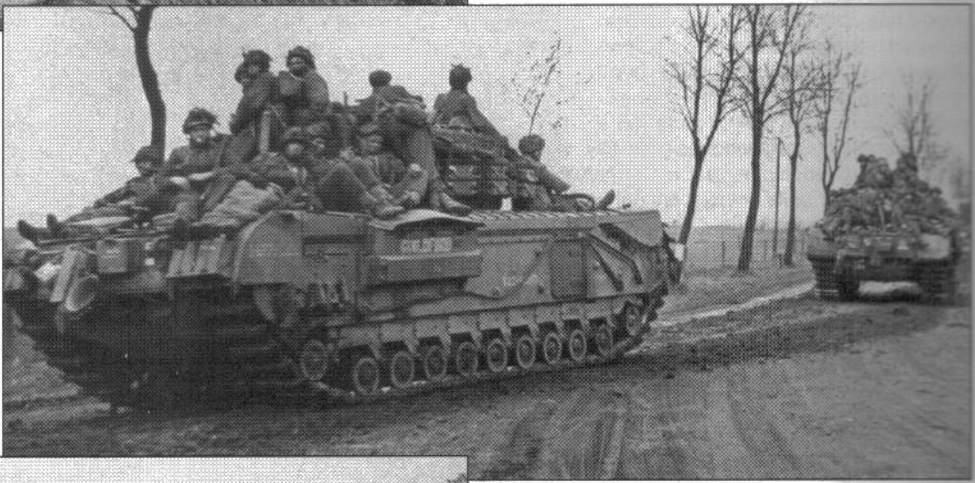
A Sherman Crab of the 79th Armoured Div. in action near Tilly-sur-Seulles on 11 July. The lead tank has obviously been damaged during mine-sweeping operations and its flail is absent; the following tanks appear intact. (The Tank Museum)

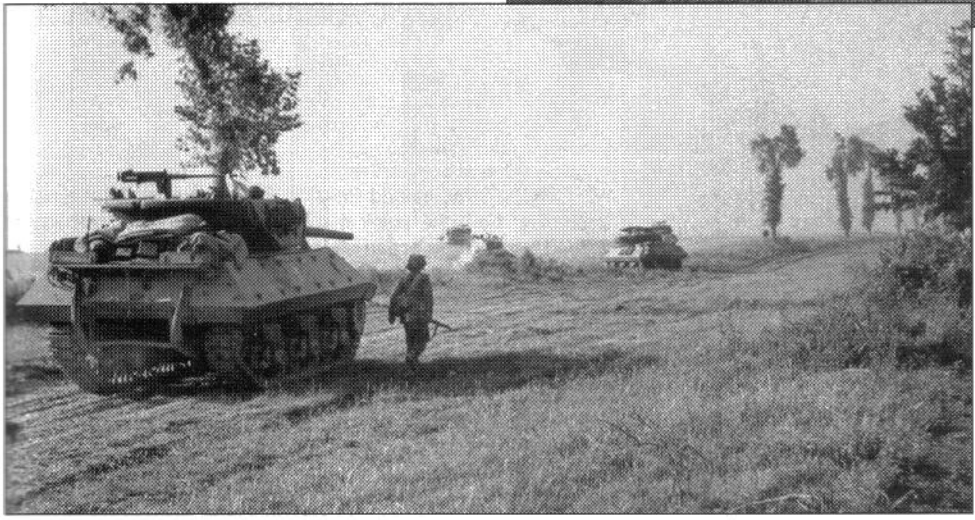




Instead of the improvised SBG bridges used by the 79th Armoured Division on D-Day, the Churchill tank brigades in Normandy were provided with the more refined Churchill Bridgelayer seen here. These were issued on a scale of one troop of three bridgelayers per brigade HQ. They were used in the Caen fighting mostly to gap obstacles and tank traps. (The Tank Museum)

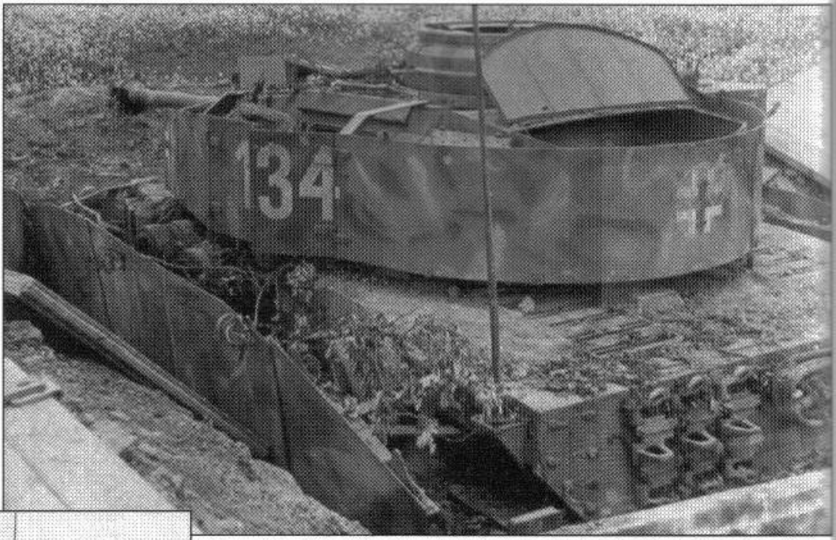
Churchill tanks were deployed with the army tank brigades, which were separate formations intended to provide support for infantry operations. These were very potent units, numbering some 242 tanks in 1944. Here a Churchill named "Guilford" moves forward, covered with infantry riders. (The Tank Museum)

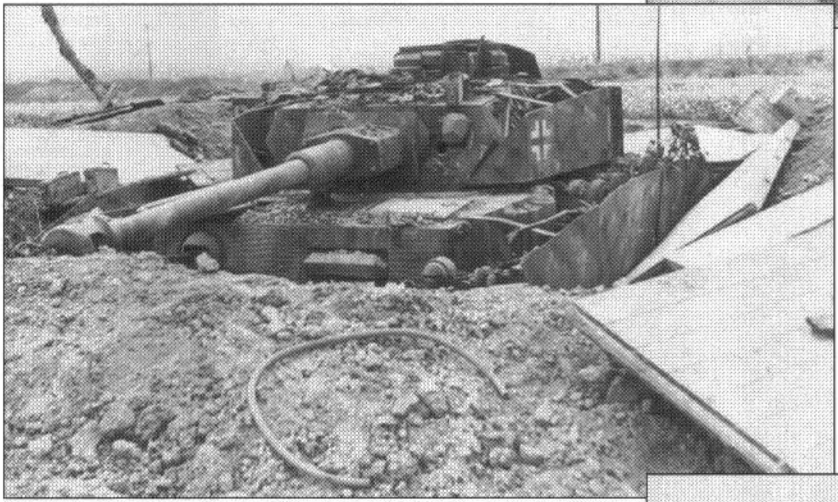




A British M10 Achilles Mk. 2 moves forward between Troarn and Caen during the July fighting. In British service, the M10 was deployed in anti-tank regiments which consisted of four batteries, with 24 M10s in two batteries, and towed 17 pdr. anti-tank guns in the other two. This differed from the American practice of deploying tank destroyer battalions equipped enitrely with towed or self-propelled guns. (The Tank Museum)

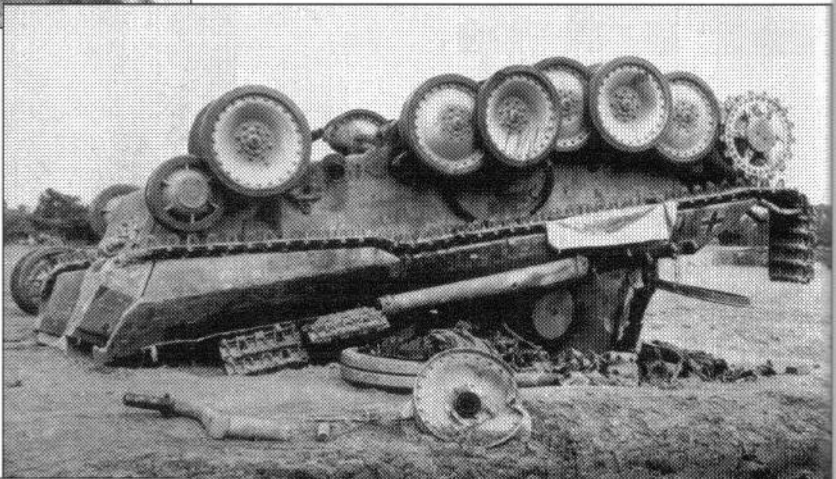
A Pz.Kpfw. IV Ausf. H of Pz.Rgt. 22 (21.Pz.Div.) knocked out near Lebisey on the northeast approaches to Caen. This photo was taken on 13 July after the British 3rd Division had captured the area. This tank has been well dug in with only its turret showing, a common tactic in the Caen fighting. This view provides a good view of the tank's camouflage painting as well as its tactical numbering. (The Tank Museum)

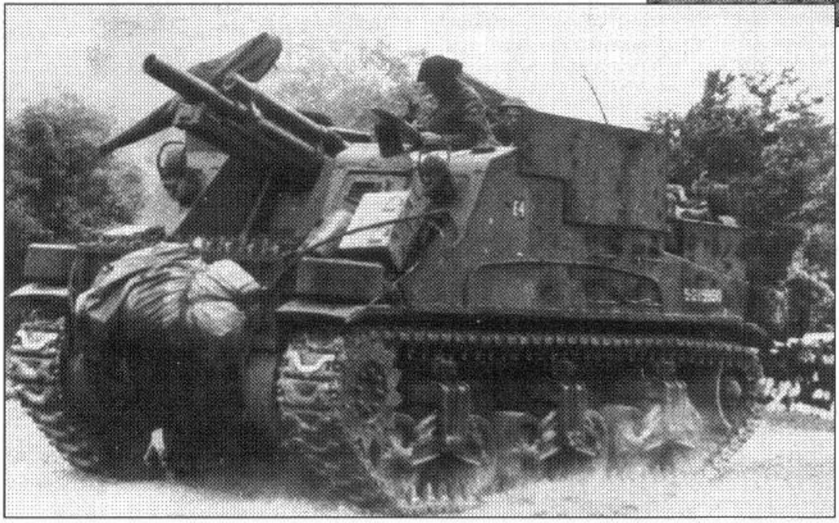




This front view of the Pz.Rgt. 22 Pz.Kpfw. IV shows the cause of its demise, a solid penetration of the turret front to the left of the gun mantlet. Dug-in tanks like this provided a real problem to the Allies, as they were very hard to detect and to knock out. The belfry of the Abayye aux Dames can be seen in the background. The flat terrain in the approaches to Caen allowed the Germans to employ their superior long-range tank firepower to bloody effect against the oncoming British and Canadian armor. (The Tank Museum)

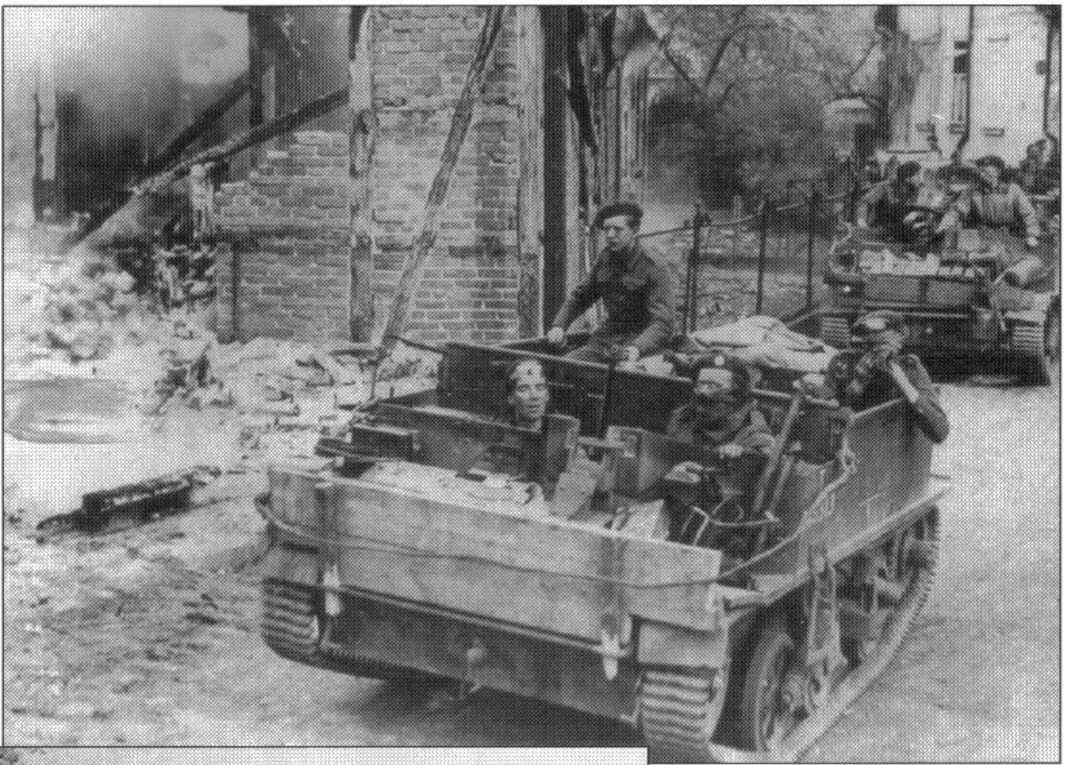
Operation Goodwood on 18 July was preceded by a massive carpet-bombing of the German forces in several key sectors. Panzer units unlucky enough to be in the bomb zones suffered significant losses. Although the aircraft bombs seldom penetrated the armor, their explosive force was often enough to completely flip the tanks on their backs, as has happened to this hapless Panther Ausf. A. (The Tank Museum)

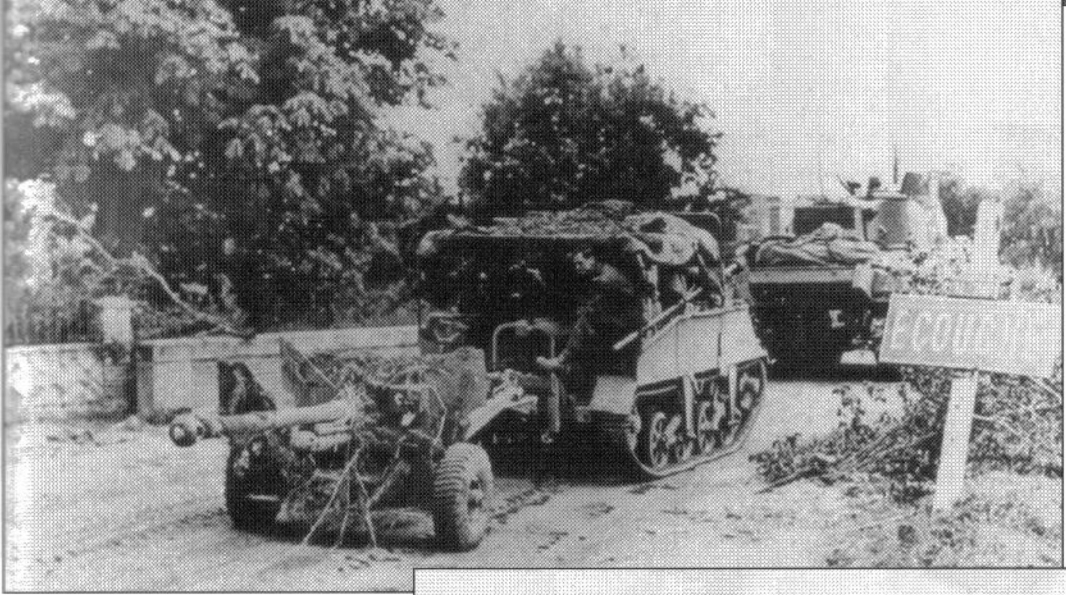




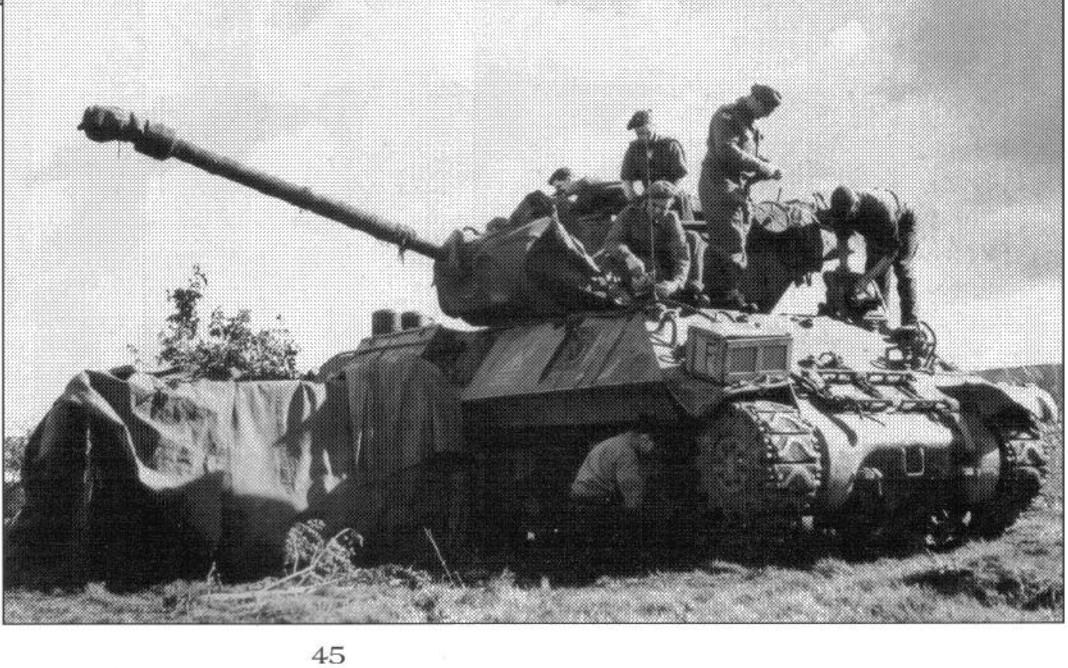
The M7 was named Priest in British service, the nickname stemming from the pulpit machine gun mounting on the right side. This Priest in action near Caen during the 18 July artillery preparation for Goodwood is still fitted with the side panels for deep wading; they were probably retained to provide some modest anti-sniper protection, The standard Royal Artillery tactical marking on the superstructure side, a blue square with a smaller red square in the lower left corner, indicates a howitzer of 3 Battery, the white E4 indicates the 4th howitzer of E Troop. The Priest was gradually replaced by the Sexton in the British army in order to standardize, and some Priests were "defrocked" later in the Normandy campaign to serve as infantry transporters. (The Tank Museum)

A Universal Carrier column moves forward in a damaged Norman village in July. The carrier was the only fully-tracked infantry vehicle commonly used during the war; both the US Army and German Wehrmacht used half-tracks. This vehicle is being used as a machine gun squad carrier, evident from the tripod stored in front. Notice also that a Boys anti-tank rifle is still being carried in the forward compartment, though most certainly not for tank hunting! The crew has placed some wooden planks on the hull front to create an improvised storage area for their equipment. (The Tank Museum)

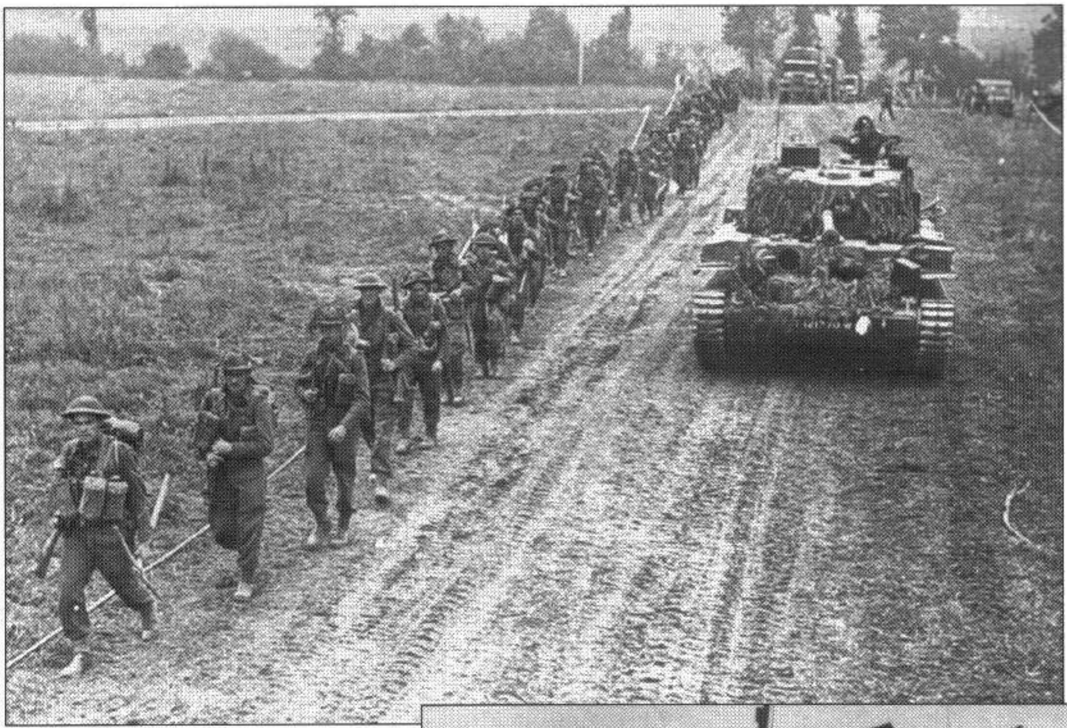




The 6 pdr. anti-tank gun was still in use in Normandy with both the British and American forces, though both were replacing it with the 17 pdr. and 76mm guns. Here one is being towed behind a Loyd Carrier, which was commonly used for this function. The carrier, with a Sherman tank in the lead, is entering Ecouche, probably in August 1944.

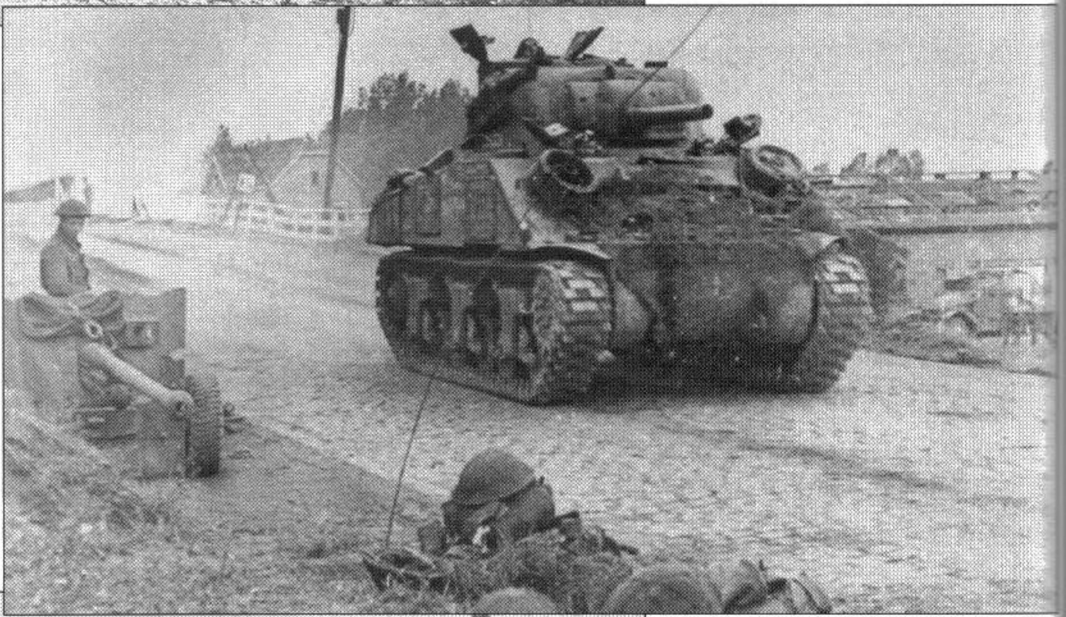


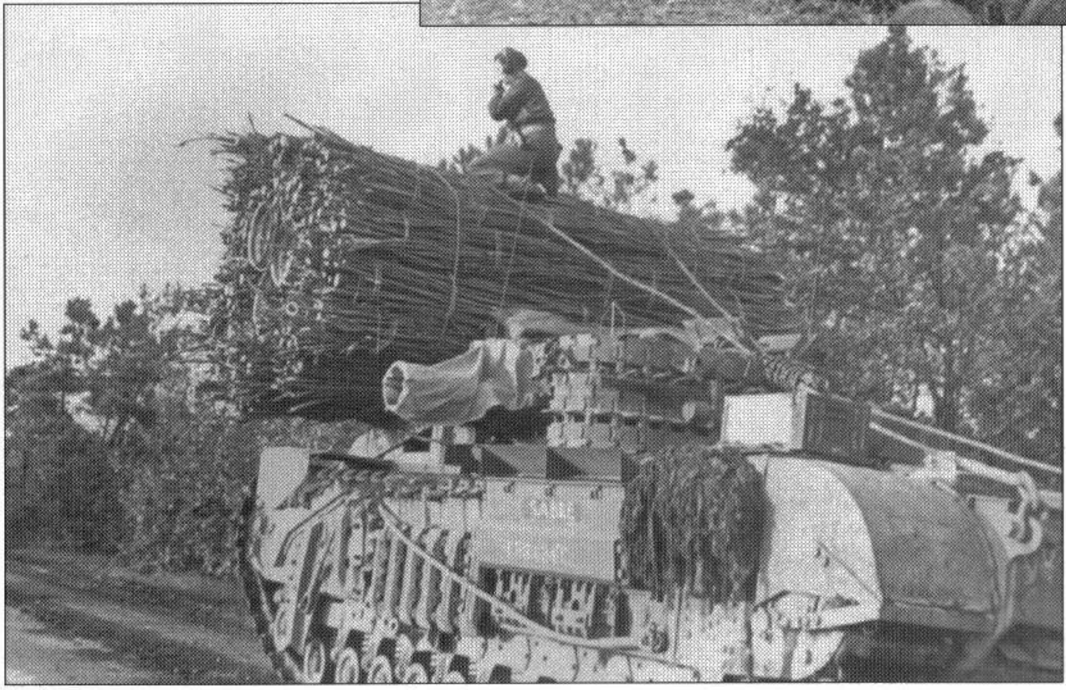
Besides being used to create the Sherman Firefly, the 17 pdr. was also used to rearm the M10 Achilles, here a Mk. IIc of the the 117 Battery, 75th Anti-tank Regt. RA, which served with the 11th Armoured Division. The 17 pdr. versions of the Achilles became the predominent version in the later stages of the northwest Europe campaigns. (The Tank Museum)



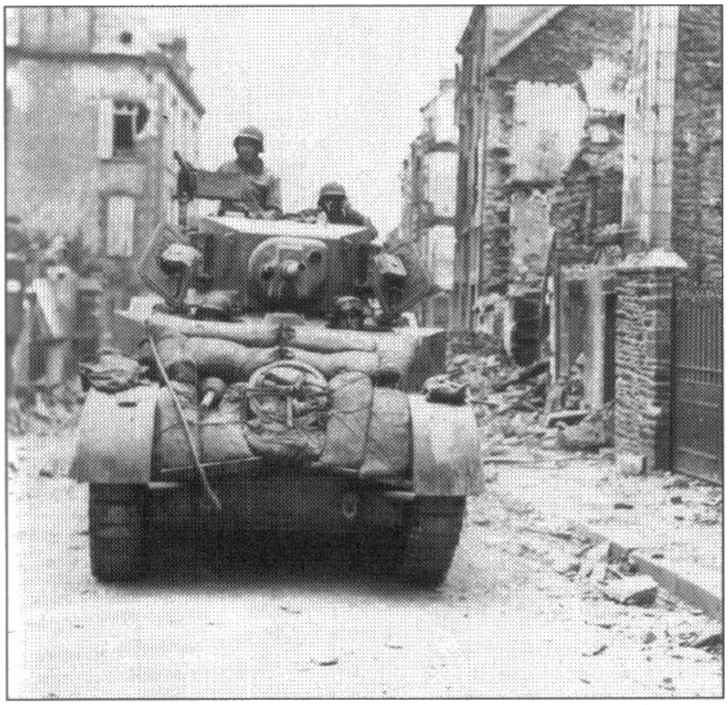
A Cromwell cruiser tank moves up past a column of British infantry. The white tape on either side of the column indicates the advance lines for moving into the jump-off points. These corridors were swept of mines and then marked by the engineers. The British built two categories of tanks, the cruiser tanks like the Cromwell intended for high speed exploitation missions, and the infantry tanks like the Churchill, which were more heavily armored and used for infantry support. (The Tank Museum)

A British Sherman moves forward on 18 July during Operation Goodwood, with a 6 pdr. anti-tank standing guard over the road. The severe losses suffered during this attempt to push into the open country south of Caen was a major stimulus for the American Operation Cobra. (US Army)

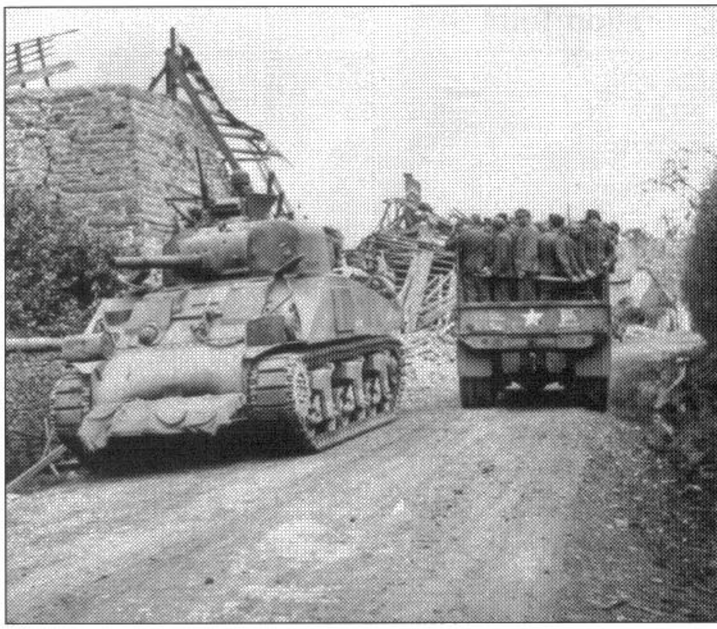




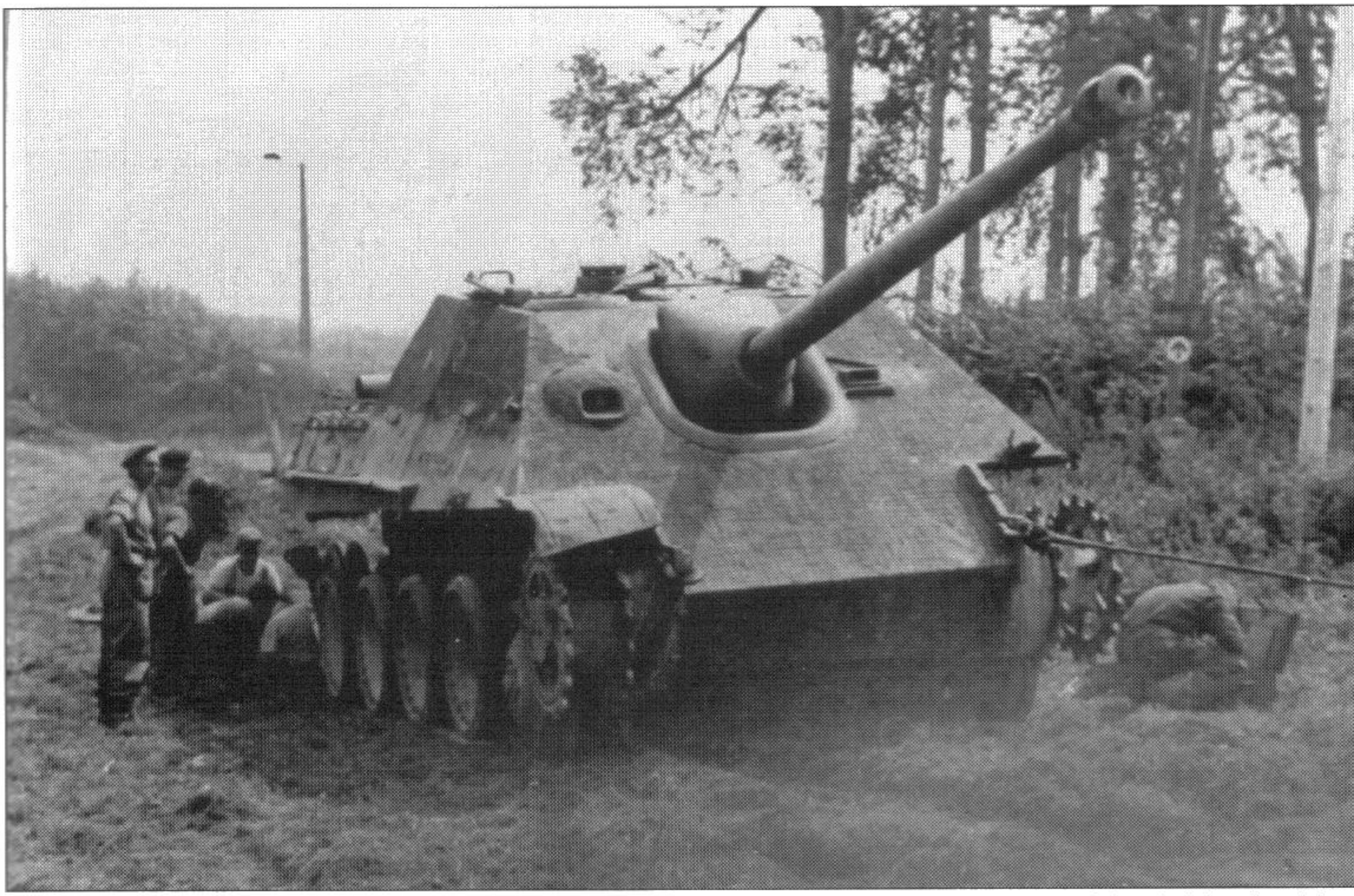
The Churchill AVREs continued to serve throughout the campaign in a variety of functions. This tank, named "Sabre", is being used to carry a fascine for filling anti-tank ditches. Note the Panther track wrapped around the turret front, an attempt to bolster the front protection. (The Tank Museum)



While the British and Canadian forces were enlocked with the German panzer divisions south of Caen, the US Army took steps to break out past St. Lo. Here, a M5A1 light tank moves through the devastated streets of St. Lo on 20 July after the city was finally captured. The first encounters with German panzerfaust anti-tank rockets prompted American tankers to begin mounting sandbags on the front of their tanks as an improvised method of bolstering their protection. (US Army)

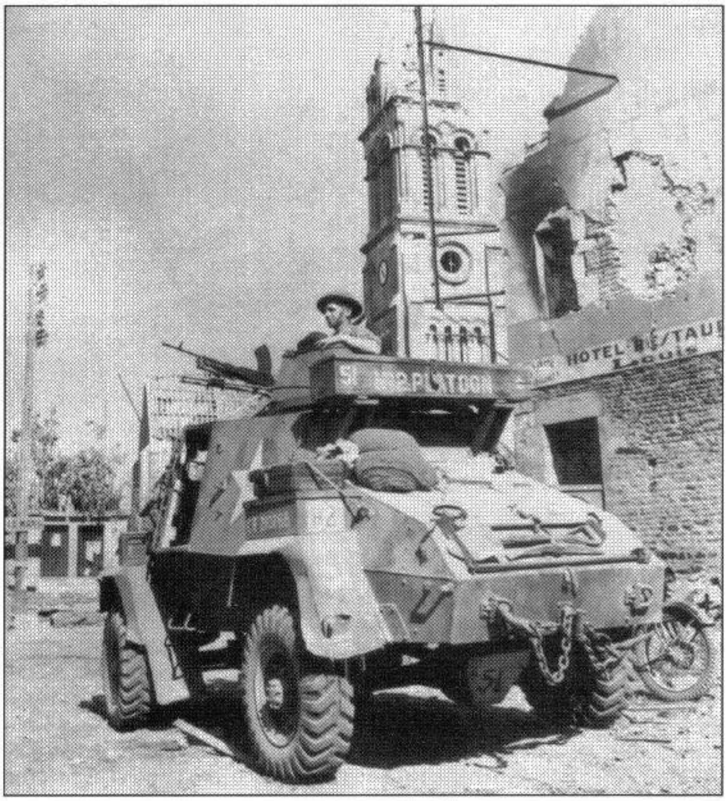


In July, a US Army sergeant named Curtis Culin devised a simple expedient to help break through the hedgerows. A "salad fork" or stee girders was welded together and attached to the transmission housing. When a tank charged the hedgerow with this device on front, it would rip into the roots and punch through them rather than the tank crashing over the top and exposing its thin belly armor to German anti-tank guns. These were called "Culin devices", "prongs" or "Rhinos". When first attached in late July as seen here, they were still secret and so were covered with canvas. (The Tank Museum)

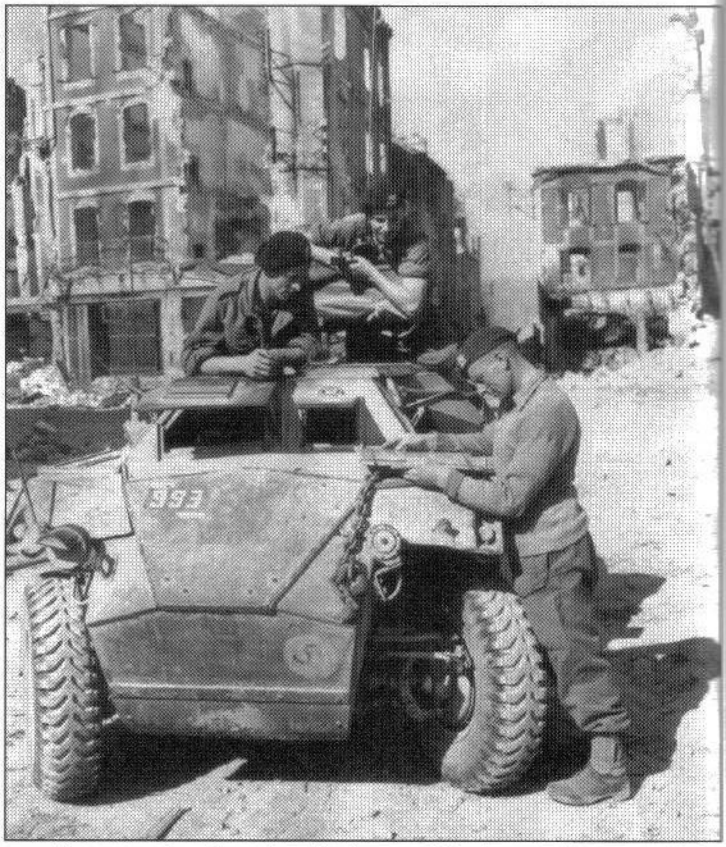


As if the Panther was not deadly enough, the Jagdpanther combined a Panther chassis with an 88mm anti-tank gun. Only a single battalion of these served in Normandy, in the British sector. On 30 July, a squadron of 6th Guards Tank Brigade was ambushed by three Jadpanthers of s.Pz.Jg. Abt. 654 near les Loges, and about ten Churchills were knocked out in quick succession. The other squadrons brought the three Jagdpanthers under fire, and two were later found abandoned with serious track damage, including the one seen here. (The Tank Museum)

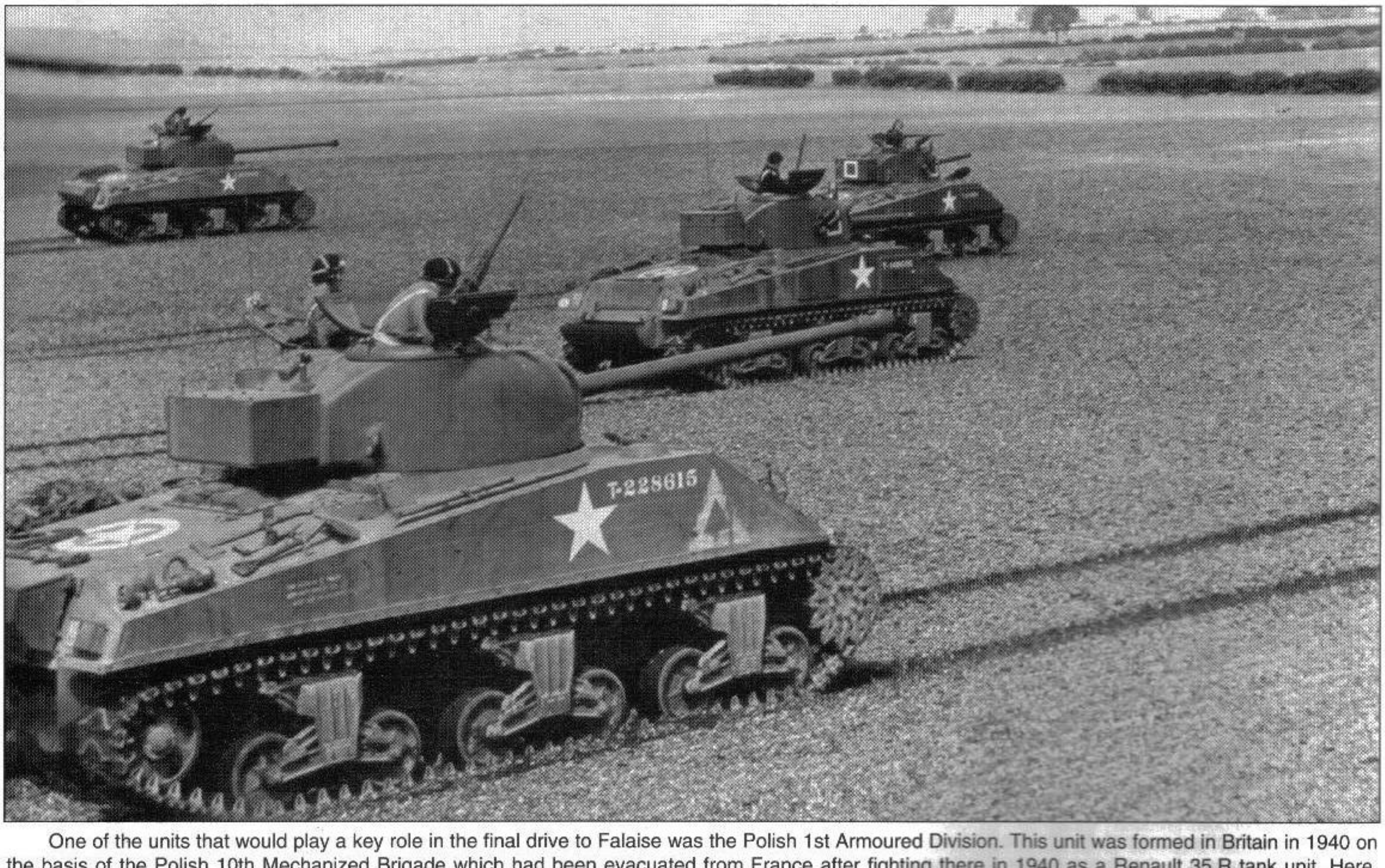
Operation Totalize



A Canadian Otter Mk. 1 of the 11 Field Co., Royal Engineers attached to the 2nd Canadian Division enters the damaged town of May-sur-Orne on 9 August 1944. The Otter armoured car was one of a number of vehicles of Canadian design to serve in the European campaign. (Public Archives-Canada)

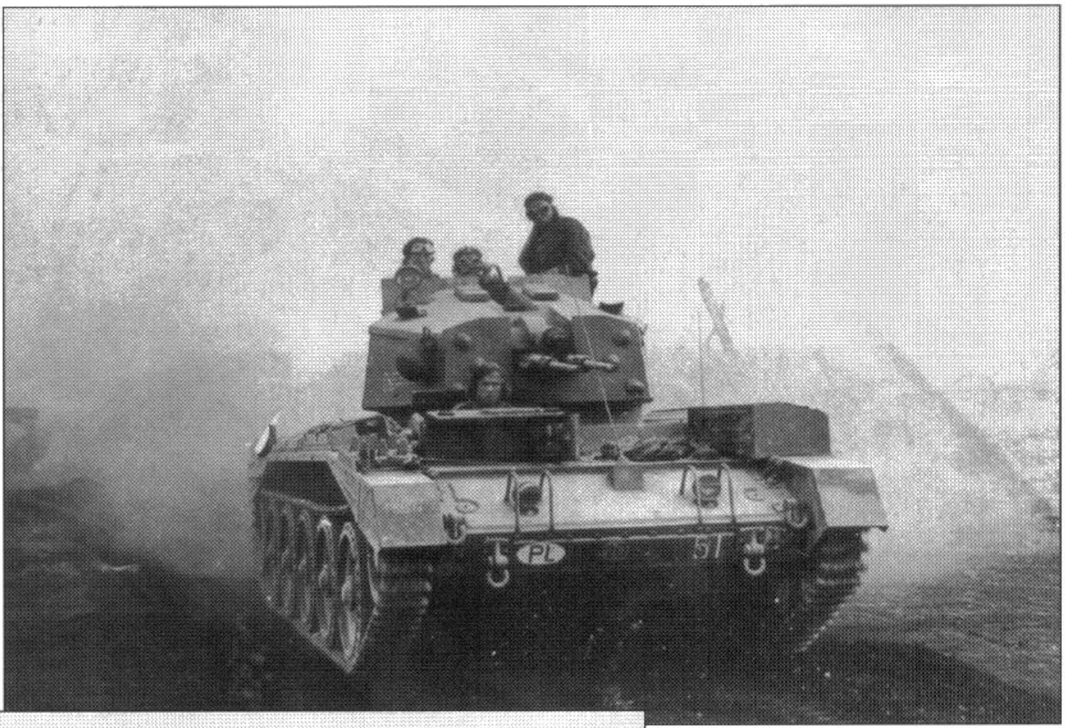


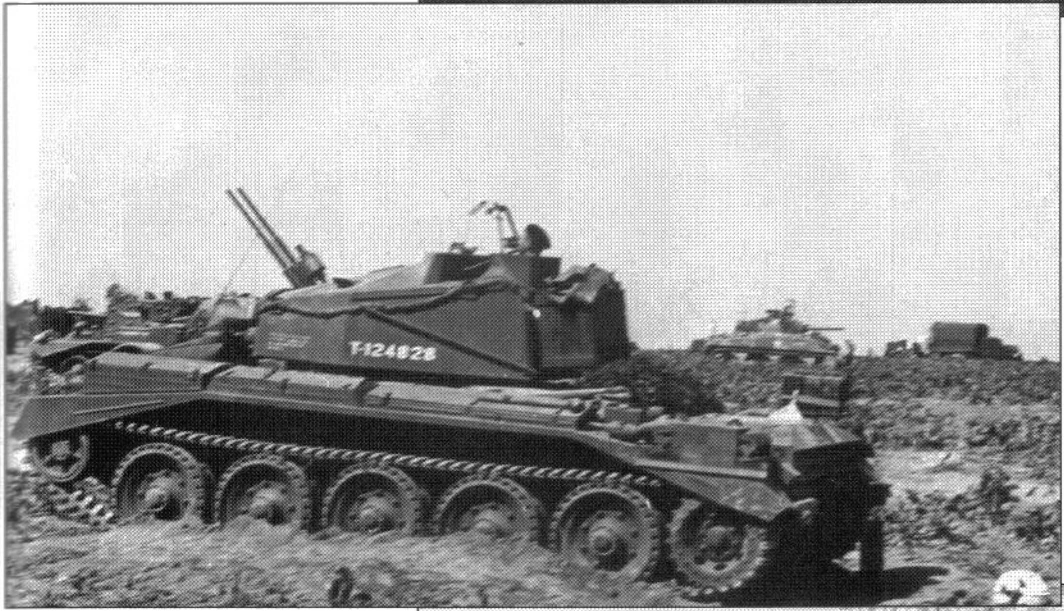
The crew of a Canadian Humberette Mk. 1 pause in a street in a destroyed French town and try to determine their location. The Humberette was a light armored car used in recce units. The 993 insignia on the bow was typically that of the third regiment of an independent brigade. (Public Archives-Canada)



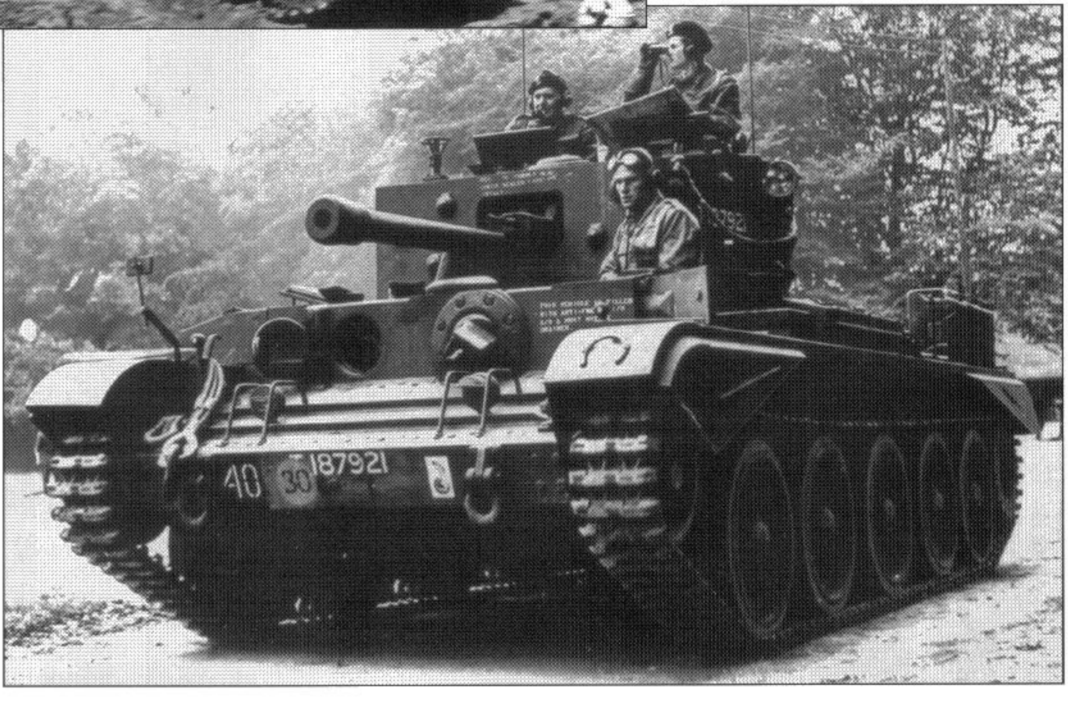
One of the units that would play a key role in the final drive to Falaise was the Polish 1st Armoured Division. This unit was formed in Britain in 1940 on the basis of the Polish 10th Mechanized Brigade which had been evacuated from France after fighting there in 1940 as a Renault 35.R tank unit. Here, Sherman Vc Fireflies and Sherman Vs of the 2nd Armoured Regt. conduct exercises prior to be committed to action. This view shows the typical markings of the Normandy campaign, especially the large allied star on the engine deck. The squadron triangle insignia is unusually large. (Pilsudski Institute)

A Crusader AA tank of the Polish 1st Armoured Regiment moves up near Cormelles near the Orne River on 25 July. This conversion placed two 20mm cannon on the obsolete Crusader tank chassis. In the absence of German aircraft, the AA tanks were used against ground targets. (Sikorski Institute)

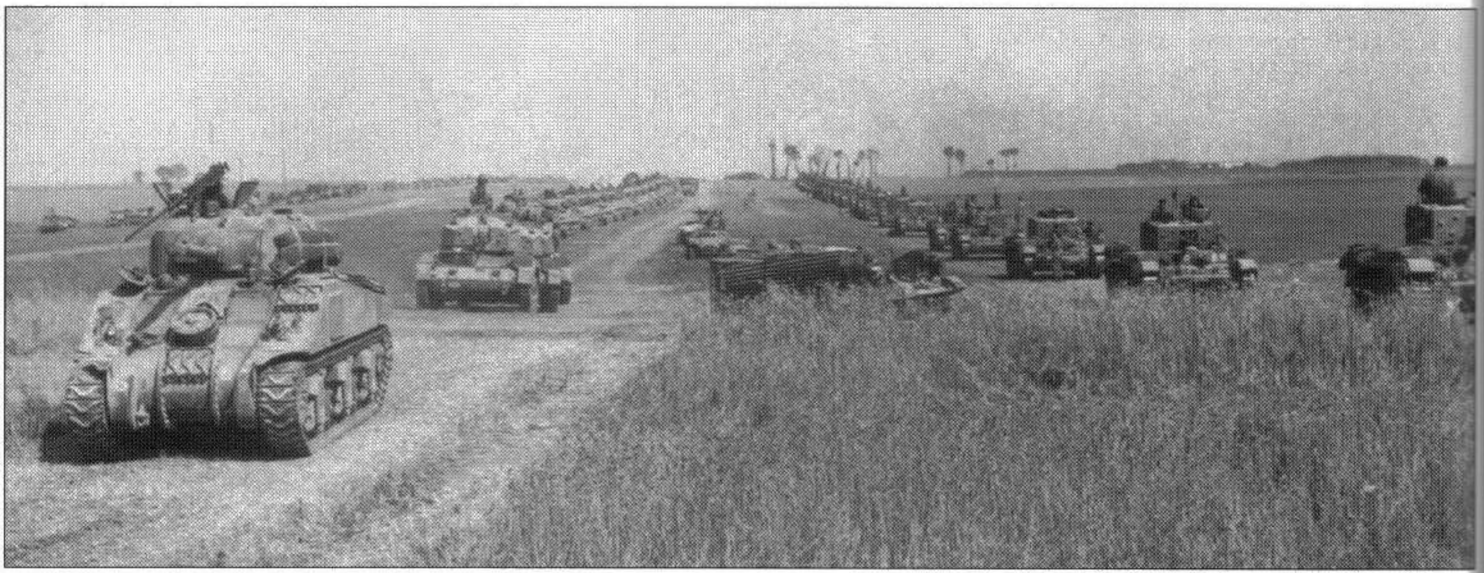




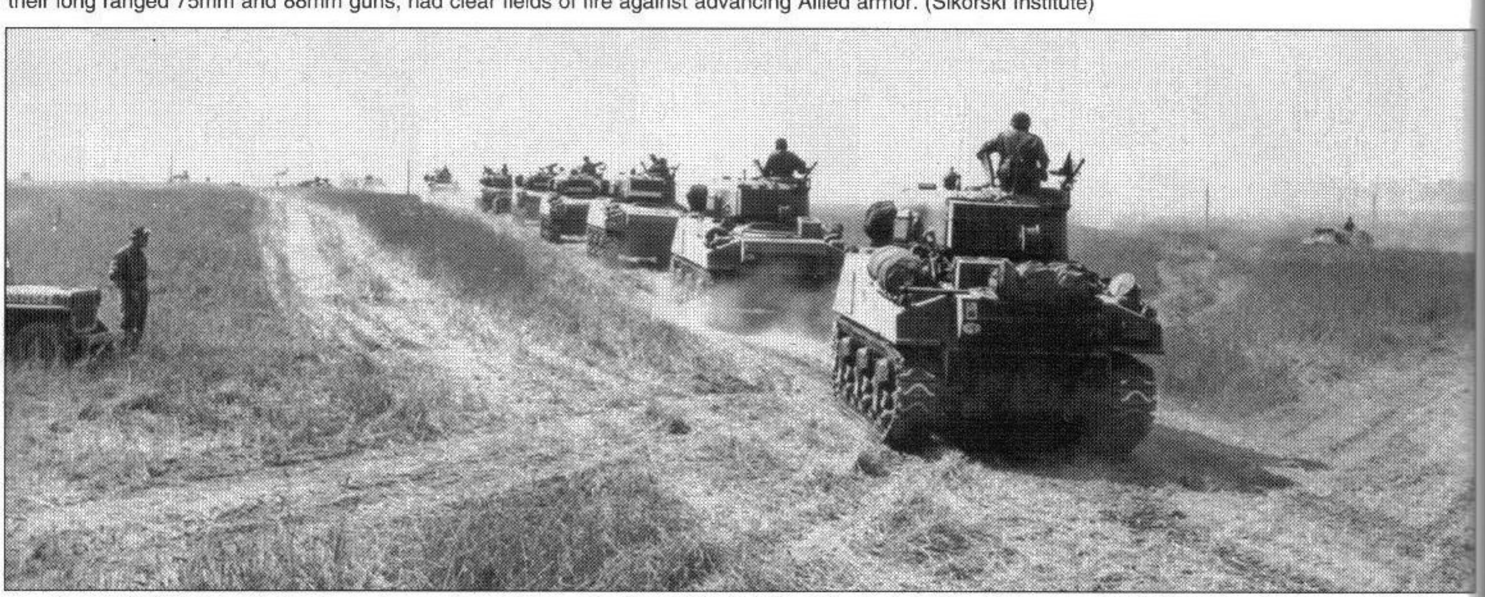
Another view of a Polish Crusader AA tank in the staging areas south of Caen. This view clearly shows the new turret fitted to this variant. The vehicle commander is using the articulated sight that was linked in elevation with the guns. (Pilsudski Institute)



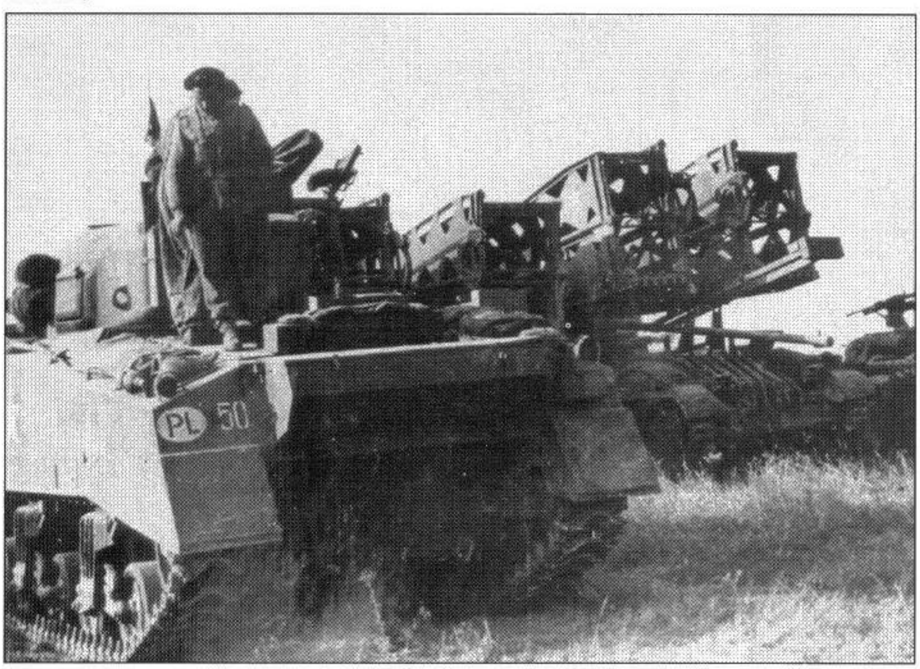
The commander of the Polish 1st Armoured Div. was Gen. Stanislaw Maczek, seen here in the right side of the turret speaking on the intercom. Maczek had extensive mechanized experience, having commanded a motorized infantry unit in the 1920 Russo-Polish War, and the 10th Mechanized Brigade in Poland in 1939 and France in 1940. This is his Cromwell command tank, which was later named Hela. Note the horseshoe on the fender, a reminder of the horse cavalry origins of the unit. (Janusz Magnuski)



The Polish 1st Armoured Division lines up in the staging area south of Caen near St. Aignan on 8 August prior to Operation Totalize. This photo gives a clear indication of why the British and Canadian tank units had such a hard time in the fighting near Caen. The terrain is very flat, and the Germans, with their long ranged 75mm and 88mm guns, had clear fields of fire against advancing Allied armor. (Sikorski Institute)

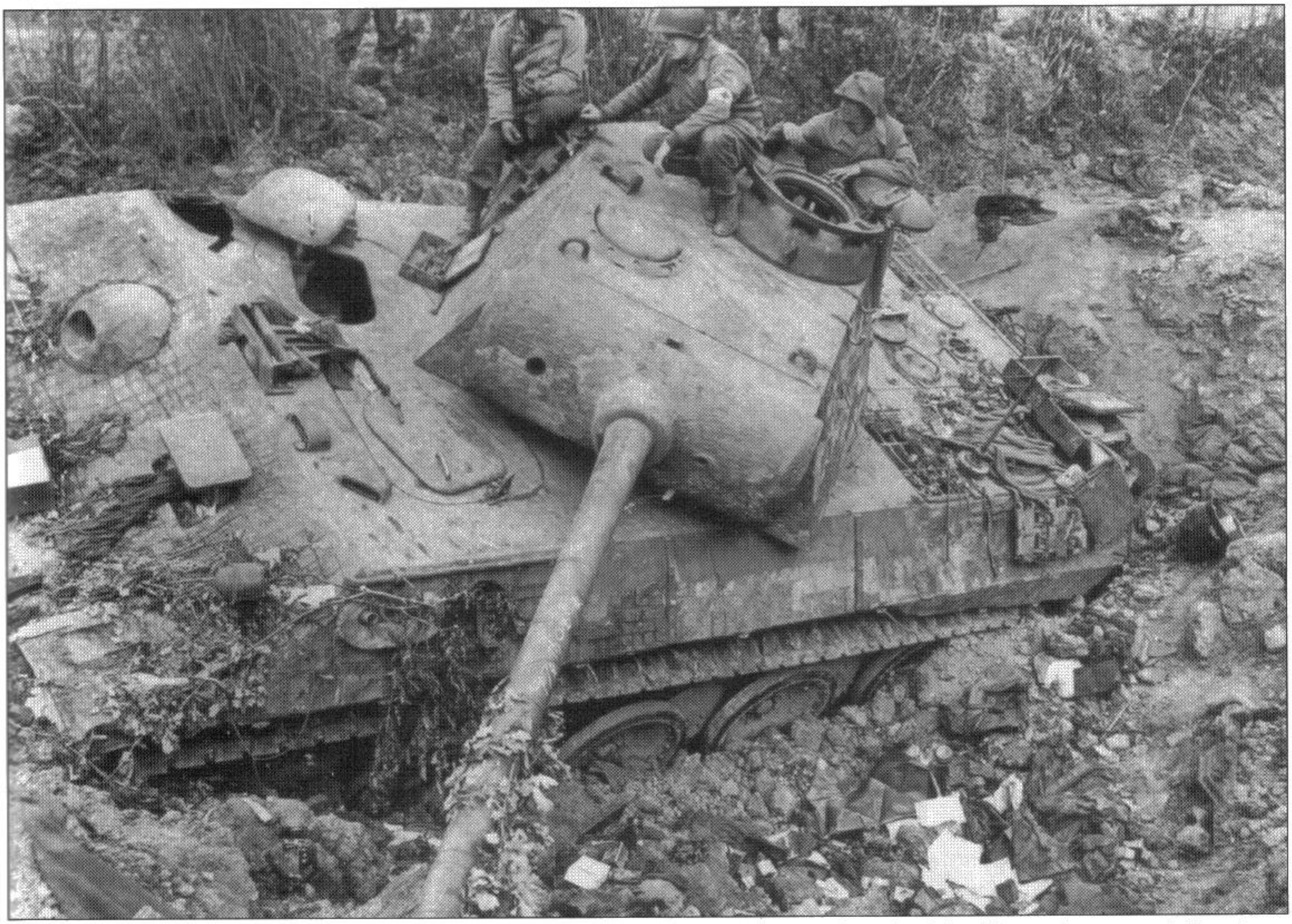


The Polish Sherman Vs begin moving south on 8 August for Operation Totalize. The fresh Polish 1st Armoured and Canadian 4th Armoured Divisions were employed in Operation Totalize due to the heavy losses endured by the three British divisions in the previous month of fighting for Caen. (Sikorski Institute)

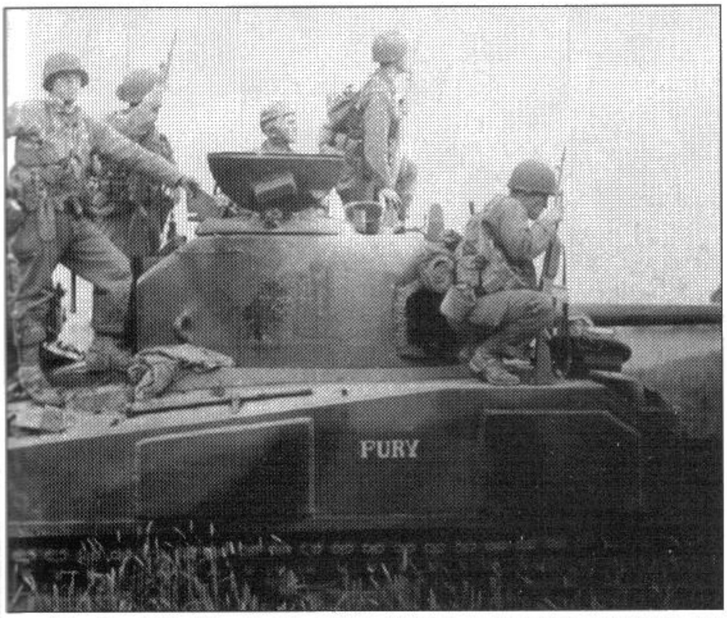


The Polish 1st Armoured Division used some of the less common types of specialized equipment in Normandy, like this Valentine bridgelayer seen behind a Sherman V of 10th Armoured Brigade headquarter troop. The Poles used the European automobile oval insignia for national identification; next to it is a white 50 on a red square which indicates the 10th Armoured Brigade HQ. (Sikorski Institute)

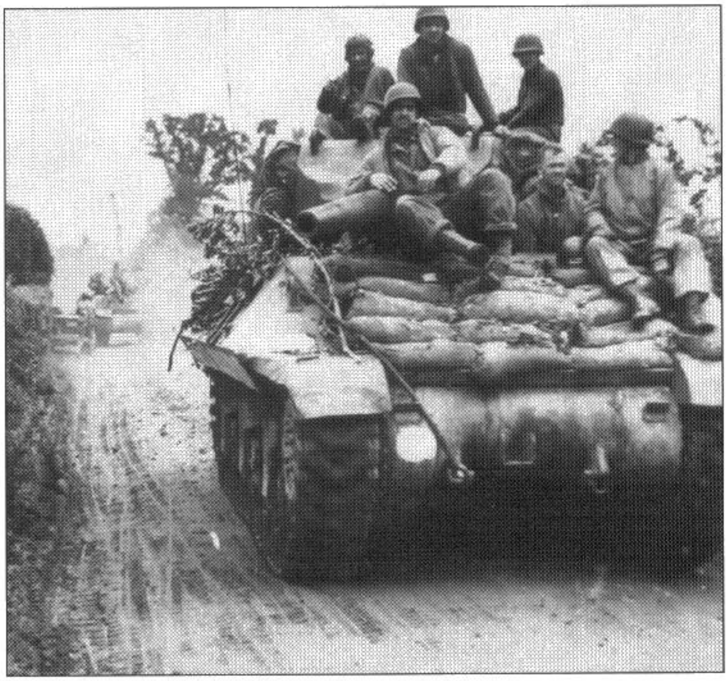
Operation Cobra



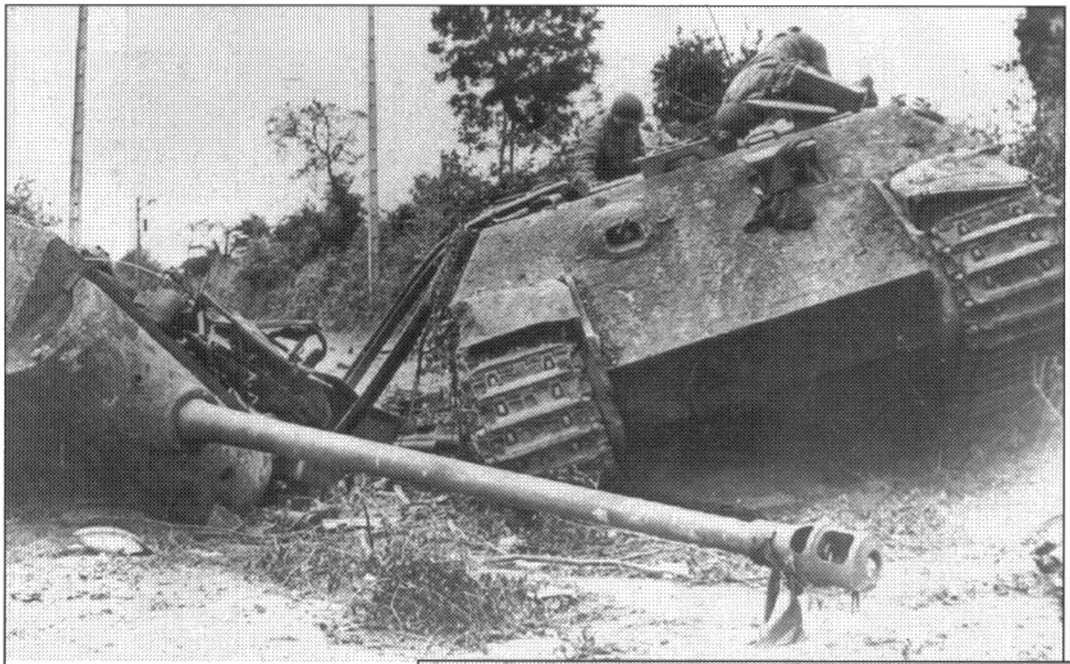
On 25 July, the US Army First Army began a major breakout operation south from St. Lo, called Operation Cobra. The attack was preceded by a heavy bombardment which wrecked the opposing Panzer Lehr Division. This Panther Ausf. A was a victim of the preparatory bombardment: note the shattered armor on the right front corner of the hull, probably caused by a bomb or aircraft rocket. (US Army)



"Fury", a M4 of the 2nd Armored Division, moves forward during the Normandy offensive with infantry onboard. This gives a good view of the applique armor added to the Sherman turret and hull side; the hull panels covered the ammunition racks. (US Army)

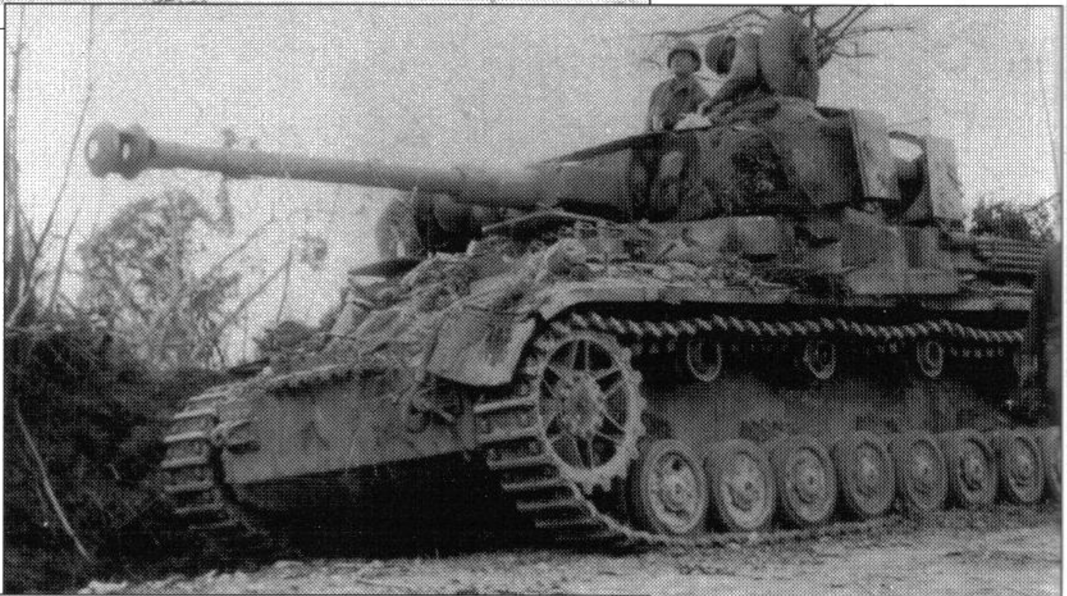


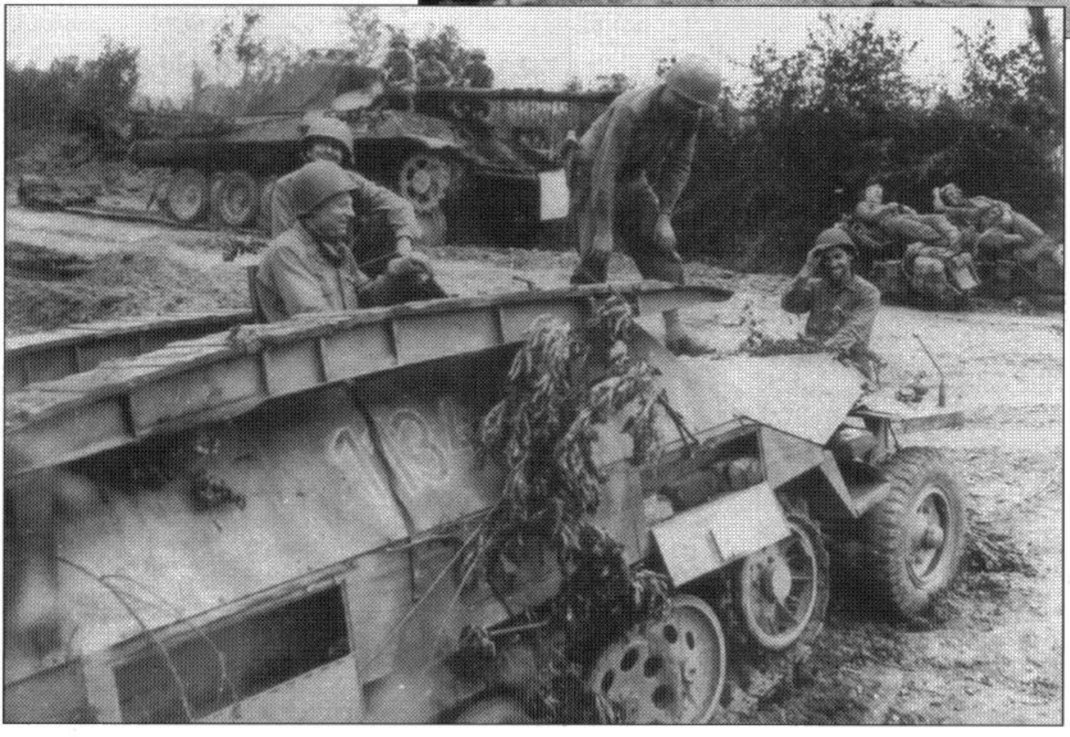
A M10 tank destroyer moves forward from St. Lo during the preparations for Operation Cobra. The M10s and M5 light tanks were among the first US armor vehicles to sport sand-bags to reinforce their thin armor. (US Army)



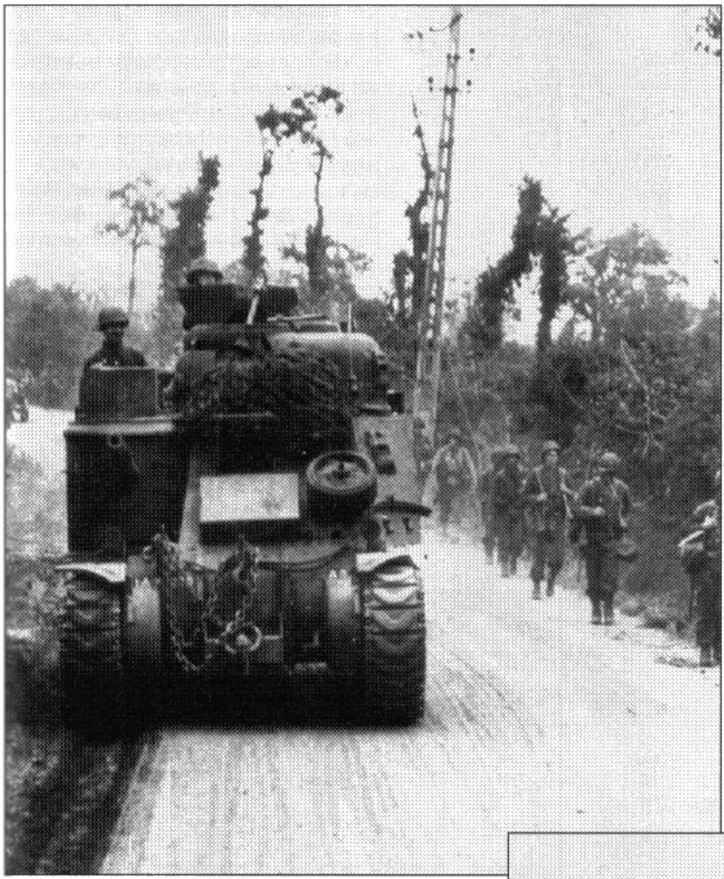
Two GIs inspect a decapitated Panther Ausf. A. This level of damage could only have been accomplished by a catastrophic internal ammunition explosion, usually caused by a penetration of the hull armor by tank fire. (US Army)

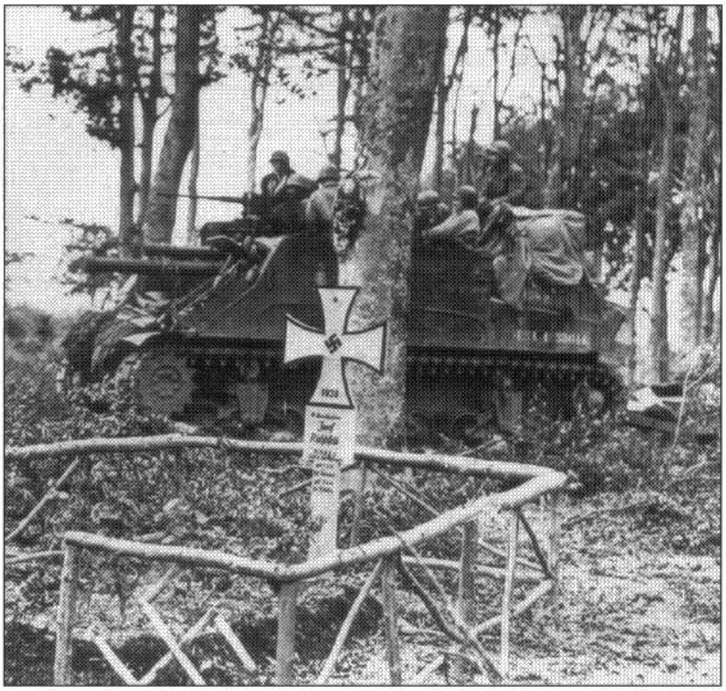
A Pz.Kpfw. IV of 8./Pz.Rgt. 130, Panzer Lehr Div. knocked out by the 2nd Armored Division during the fighting near Roncey during Operation Cobra. The Panzer Lehr Division was reduced to less than 30 tanks by the month of bocage fighting and the heavy bombardment that preceded Cobra. (US Army)





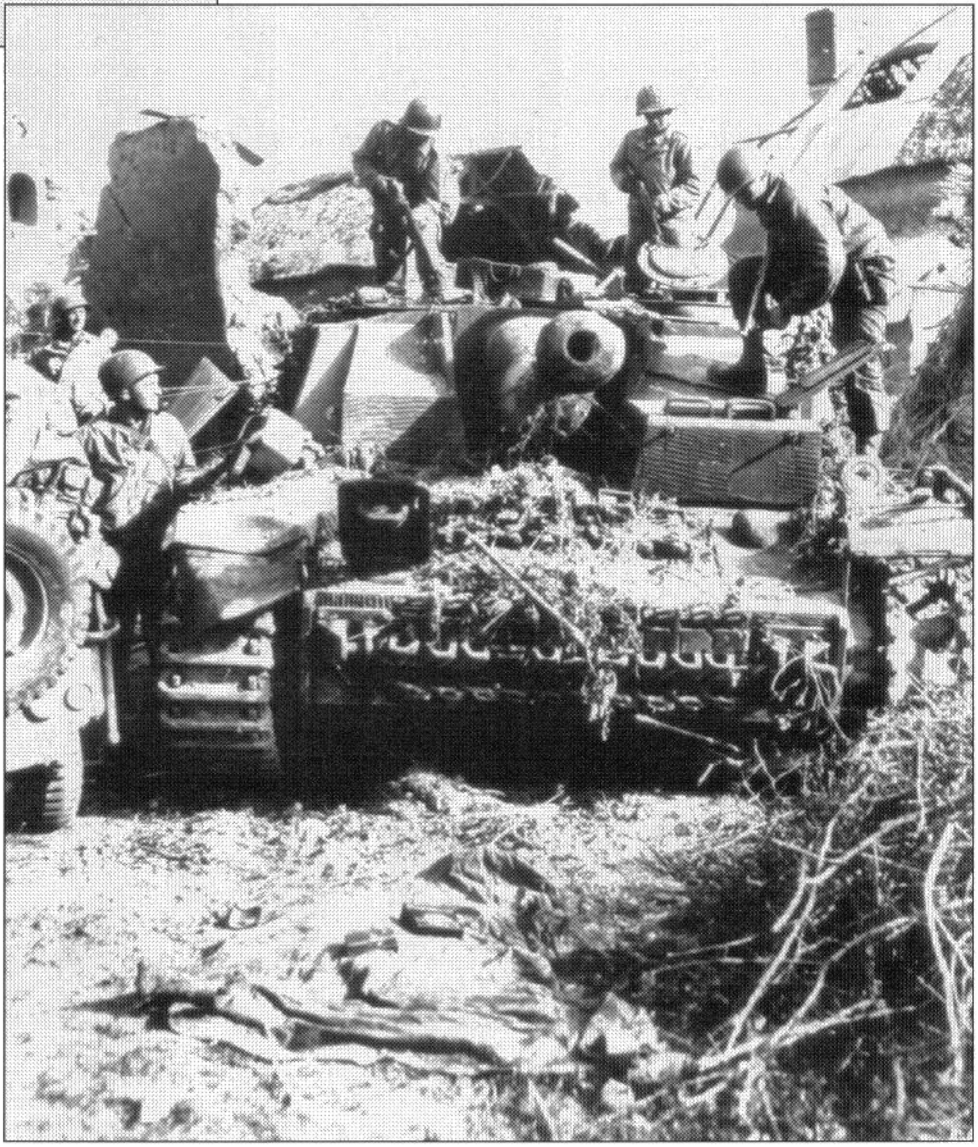
GIs examine knocked out German armor on 26 July during Operation Cobra on the road to Periers. The nearest vehicle is a Sd.Kfz. 251/7 engineer vehicle with a small gap-filling bridge mounted on the superstructure. In the background is a knocked out Panther Ausf. A. Both vehicles were probably from Panzer Lehr Division. (US Army)



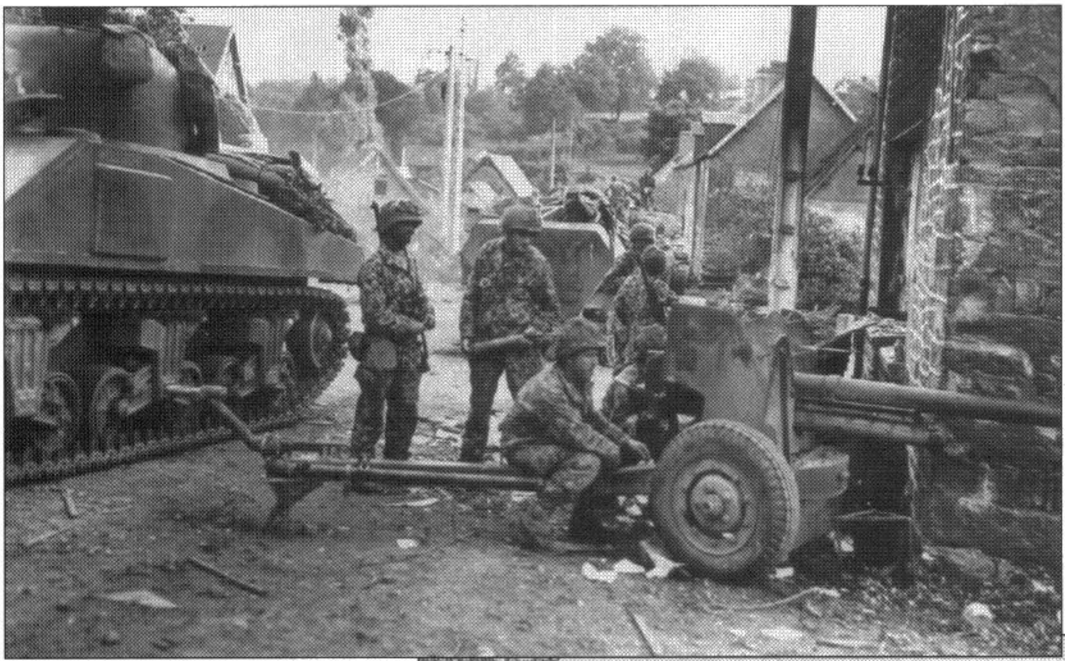


An M7 105mm HMC moves through a small woods on 29 July during the breakout. In the foreground is the grave of a German artilleryman from SS-Art. Rgt. 17 killed in the earlier fighting. Artillery was the one combat arm where the US had unquestioned technical and numerical superiority over the Germans. (US Army)

This photo taken on 26 July gives a good impression of the bocage country, with dense hedgerows on either side of this road. The vehicle is an M31 armored recovery vehicle, the only significant version of the obsolete M3 medium tank to be employed by the US Army in Normandy. (US Army)

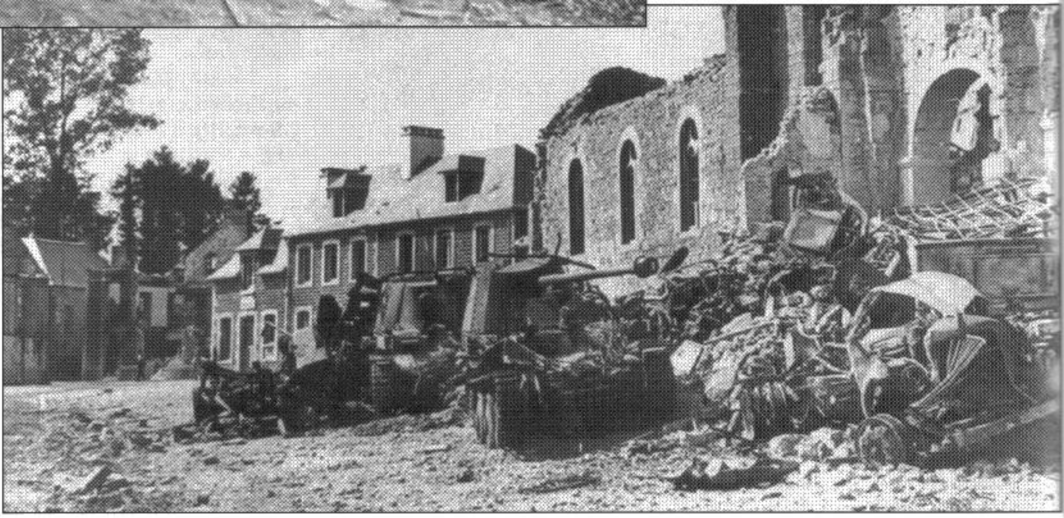


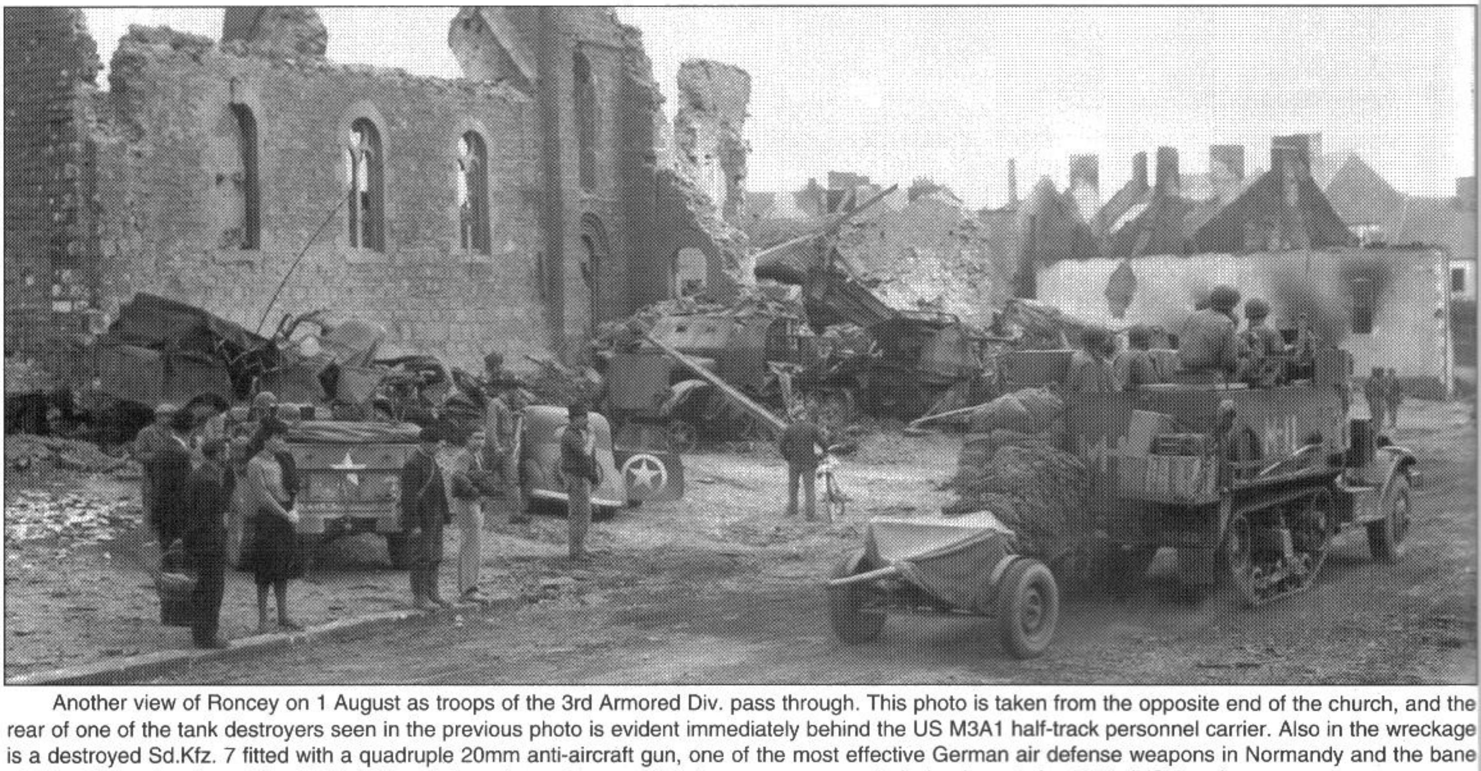
US troops inspect a destroyed StuG IV on 29 July during the breakout. This assault gun was based on the Pz.Kpfw. IV chassis instead of the more common StuG III on the Pz.Kpfw. III chassis. The troops are probably looking for booby-traps, which was a common German ploy when abandoning equipment. (US Army)



An anti-tank team equipped with the M1 57mm anti-tank gun takes up position in a Breton village as M4 Sherman tanks pass by. The 57mm gun was an American copy of the 6 pdr. anti-tank gun; although still effective against light armored vehicles, by Normandy it was obsolete when faced by formidible German tanks like the Panther. The crew of the gun wear the rare US camouflage fatigues. These disappeared after the summer of 1944 as US troops tended to mistake anyone wearing them with Germans. (US Army)

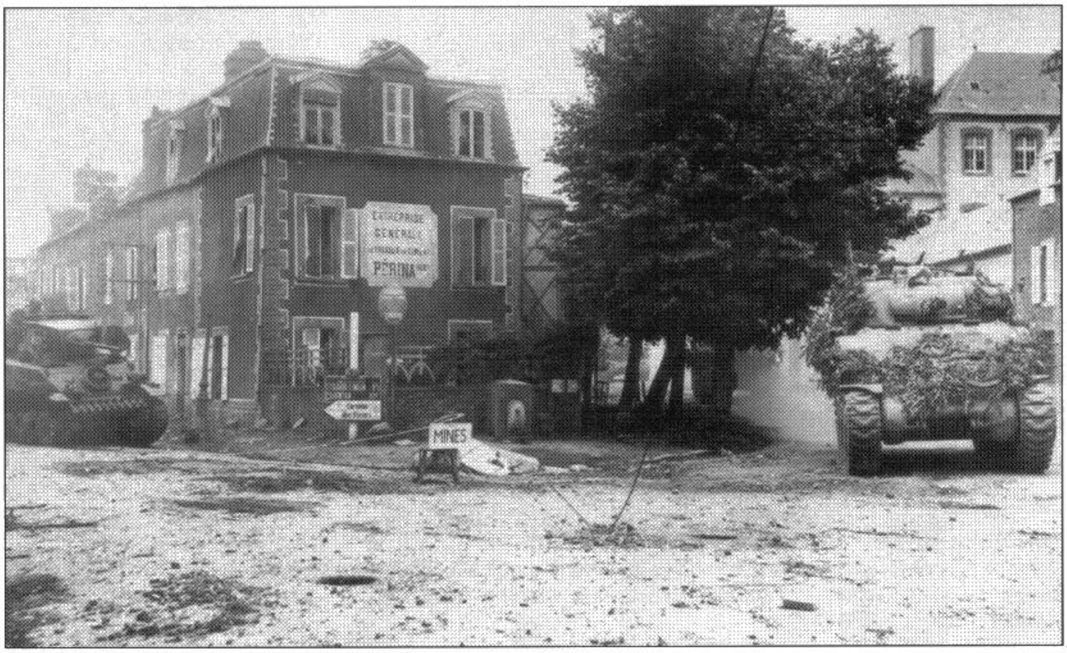
Roncey was a key town sandwiched between the 2nd and 3rd Armored Divs. during Operation Cobra. Here is a view of a pair of 7.5 cm Pz.Jaeger 38(t) Ausf. M (Sd.Kfz. 138) tank destroyers of the SS-Pz.Jg.Abt. 2 of the 2.SS-Pz.Div. lying amidst the wreckage of the town church in Roncey on 30 July 1944. These vehicle were probably knocked out by air strikes. (US Army)

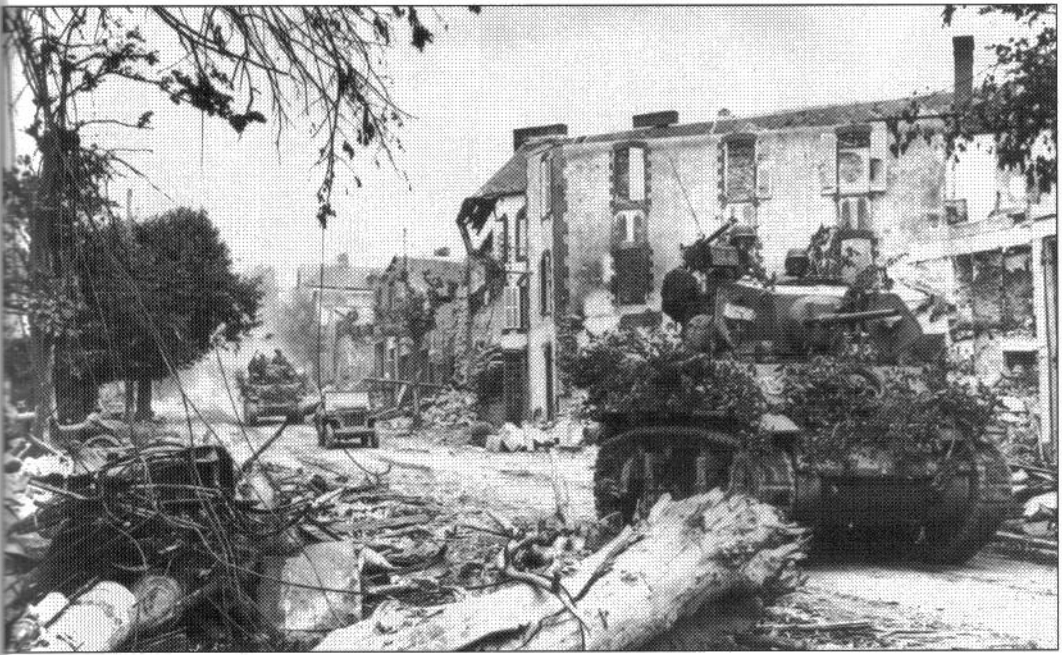




Another view of Roncey on 1 August as troops of the 3rd Armored Div. pass through. This photo is taken from the opposite end of the church, and the rear of one of the tank destroyers seen in the previous photo is evident immediately behind the US M3A1 half-track personnel carrier. Also in the wreckage is a destroyed Sd.Kfz. 7 fitted with a quadruple 20mm anti-aircraft gun, one of the most effective German air defense weapons in Normandy and the bane of Allied fighter bombers. The M3A1 half-track is towing a 37mm anti-tank gun, a weapon wholly inadequate by 1944. (US Army)

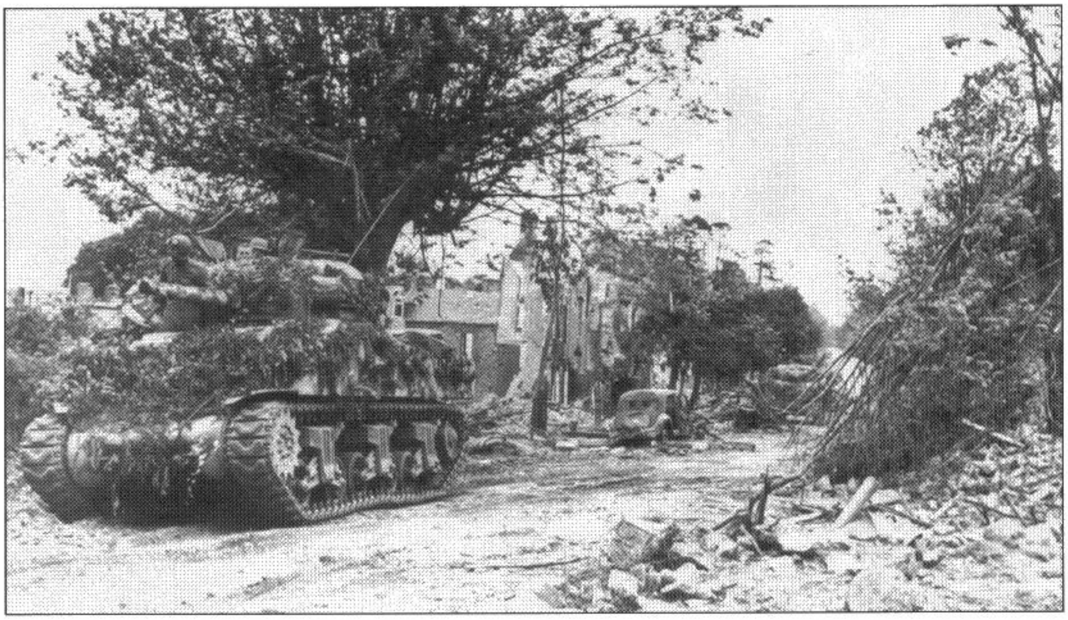
A M4 medium tank of 4th Armored Div. makes its way through Coutances on 30 July 1944. The city was taken by 4th Armored Div. on the evening of 28 July and to the left is a M5A1 light tank that was disabled during this operation by a mine which blew off its right track. Engineers have subsequently taped off the wreckages and placed a sign warning off other units. (US Army)

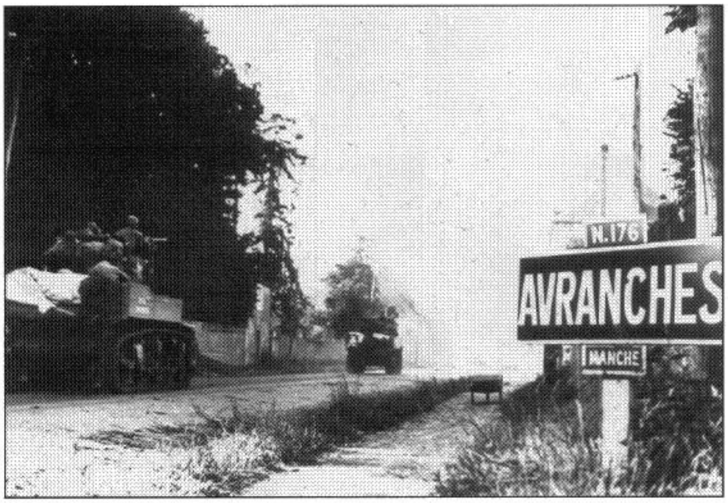




A M5A1 light tank makes its way through the ruined streets of Coutances on 30 July. Several of the battalions of this division festooned their tanks with foliage camouflage before the breakthrough as is very evident on this light tank. By Normandy, the M5A1 light tank was hopelessly armed, and its 37mm gun was effective only against lightly armored German vehicles. The better armed M24 light tank did not appear until December 1944. (US Army)

A M4 medium tank of 8th Tank Battalion, 4th Armored Div. passes through Coutances on 31 July. This particular battalion heavily camouflaged their tanks, not only with foliage, but with mud camouflage barely evident under the branches. This division, first heavily committed during Operation Cobra, would prove to be one of the best US armored divisions in Europe, leading Patton's Third Army's relief of Bastogne later in the year. (US Army)





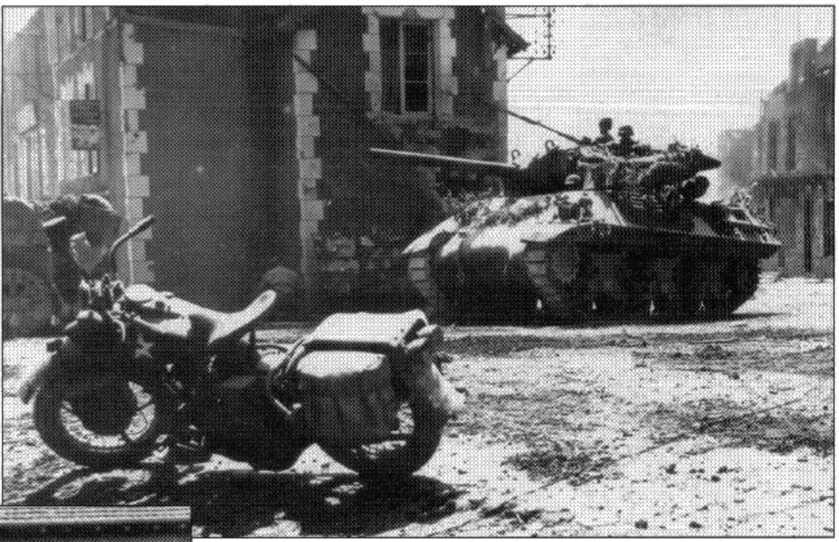
US Army M5A1 light tanks advance into Avranches on 31 July. The 4th Armored Division first entered the city the previous evening, marking a 68 km race in only three days. The fighting in late July bagged the last major concentration of German troops opposing Cobra, with the remainder in headlong retreat. (US Army)

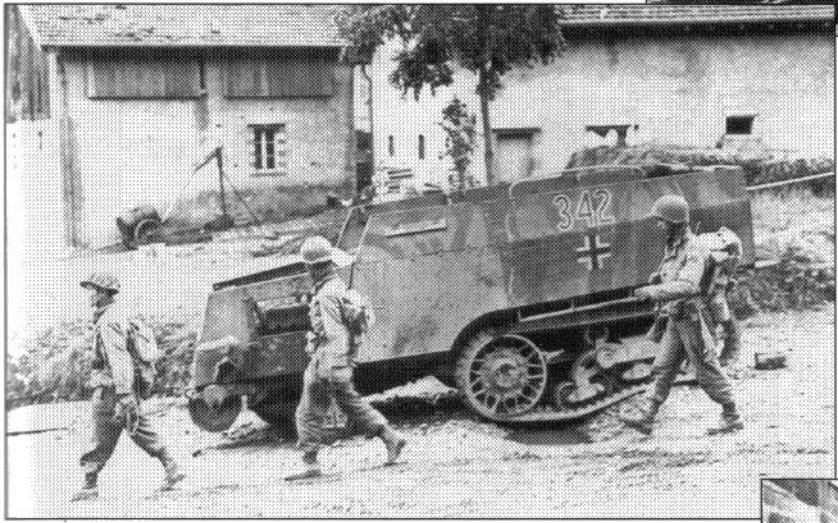
The crew of a M4 medium tank watch as some members of the local French *maquis* resistance take a local collaborator into custody. Fraternization with German troops was usually punished with a shaved head, but more serious offenses often led to rough and ready justice by the *maquis*. (US Army)

A M4 medium tank of 6th Armored Division passes through Avranches on 31 July. Both 4th and 6th Armored Division had swept south along the coast, meeting at Avranches, before proceeding west towards the key seaport of Brest. On the engine deck of this tank is a fluorescent identification panel, a standard Allied air identification symbol used to prevent attacks by Allied aircraft. (US Army)

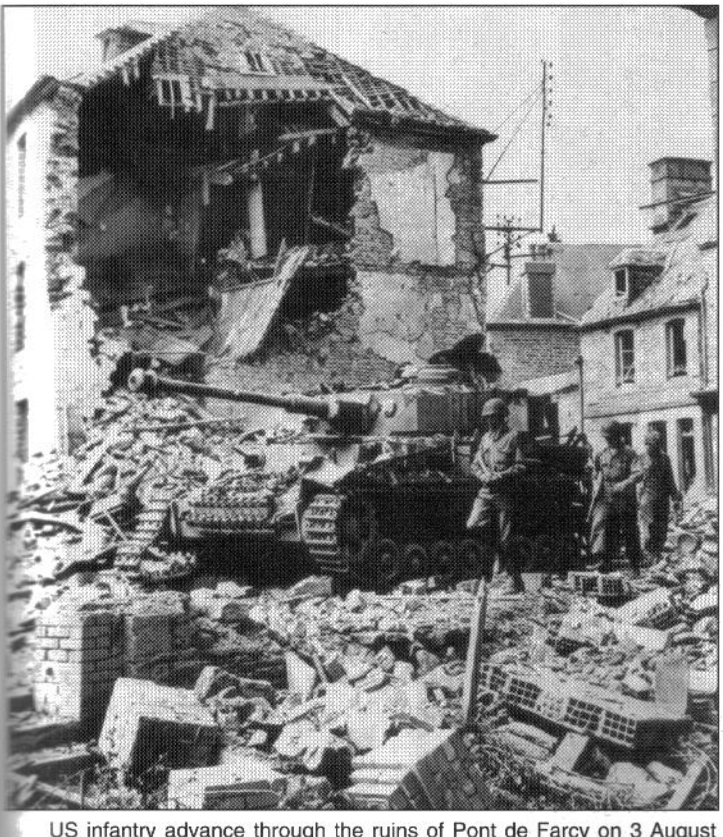
A M4A1 medium tank pushes forward across the open farm country of Brittany in early August 1944, the field littered with abandoned German equipment including this German Sd.Kfz. 11 3-ton half track to the right of the tree. Due to the availability of ample half-tracks, infantry tank riding was not as commonly used a tactic in the US Army as in the German or Soviet armies during the war. (US Army)

A M10 3-inch tank destroyer passes through the town of Percy on 1 August 1944. At this stage of Operation Cobra, the collapse of German resistance led the US Army to move in two directions, to the west to seize Brest and the Breton peninsula, and to the east, as part of an exploitation effort towards Paris and the Seine river to cut off remaining German forces in Normandy. (US Army)

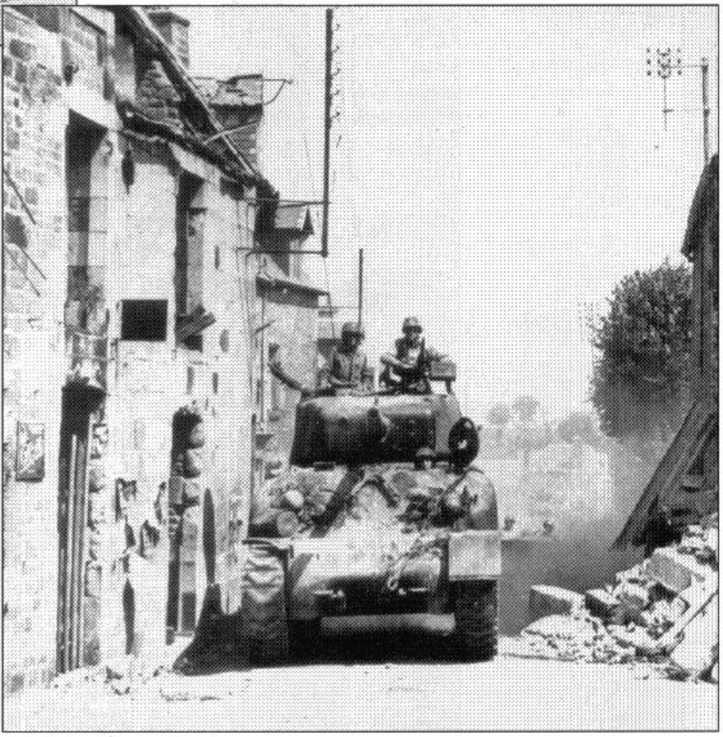




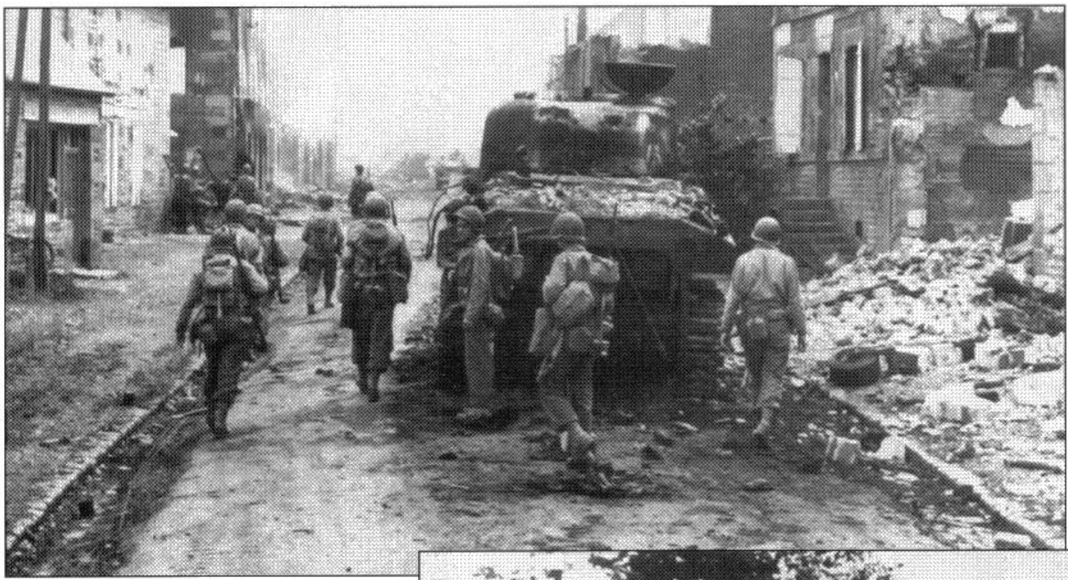
US infantry marches past an abandoned German Schutzenpanzerwagen U 304 (f) which was a local improvisation based on French Unic P 107 half-tracks. This half-track has lost its front left wheel to a mine, and the crater is still evident below the track assembly. (US Army)



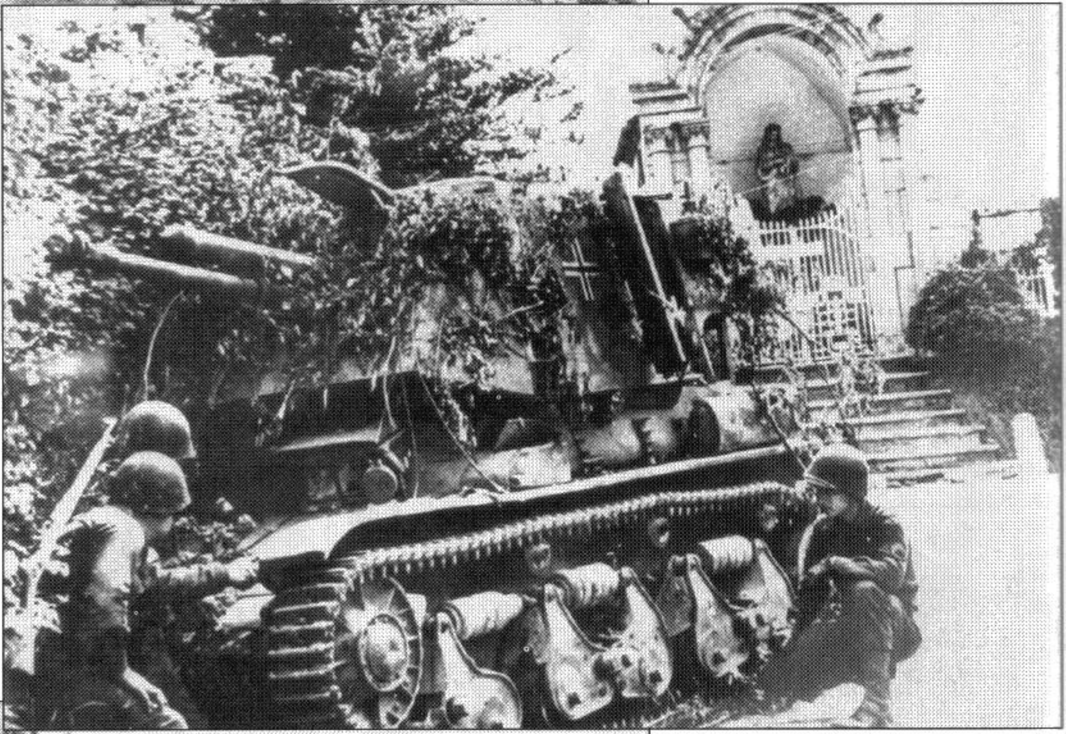
US infantry advance through the ruins of Pont de Farcy on 3 August 1944. The abandoned Pz.Kpfw. IV is believed to have been from the 2.Panzer Div. and was apparently abandoned after losing its right track in the rubble. (US Army)



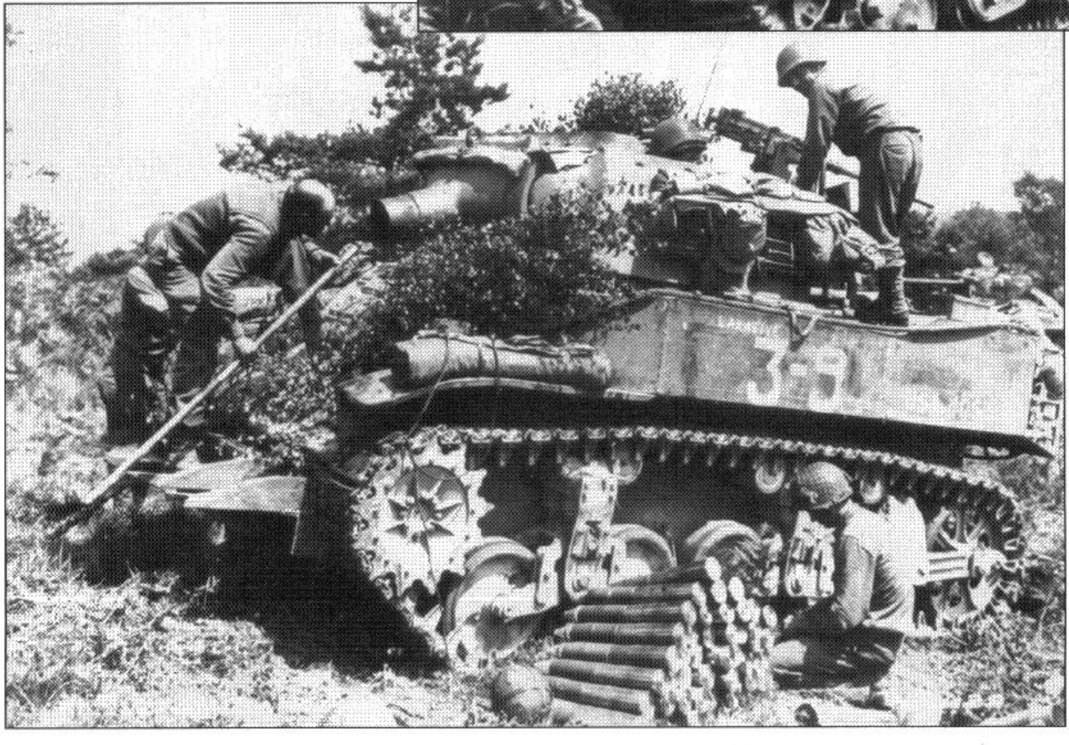
A M4A1(76) W medium tank of the 67th Arm'd. Regt., 2nd Arm'd. Div. enters St. Sever Calvados on 3 August 1944. The US Army began receiving its first 76mm-armed M4A1 tanks in June, immediately before the invasion but there was little initial enthusiasm for them due to their poor high-explosive projectile and the logistical complications of operating 75mm and 76mm gun armed tanks together. After meeting the Panther, the attitude quickly changed and units clamored to get more of these tanks as soon as possible. They were not very effective against the Panther except when firing "souped-up HVAP", a new type of high velocity projectile that was in short supply until 1945. (US Army)



On the evening of 6-7 August, the German XLVII Panzer Korps launched Operation Luttich, an ambitious counteroffensive near Mortain in an effort to cut off the advancing US Army spearheads by pushing from Mortain to the Atlantic near Avranches. The offensive failed to overcome stiff resistance from the US 30th Infantry Division and was stymied by Allied air attack. This photo was taken before the German attack when US infantry from the 30th Division initially captured Mortain. The M4 medium tank here was knocked out in the fighting and is completely burned out. Although the Sherman had a bad reputation for its tendency burn, ammunition fires were the main culprit, not its gasoline engine as is so often presumed. (US Army)

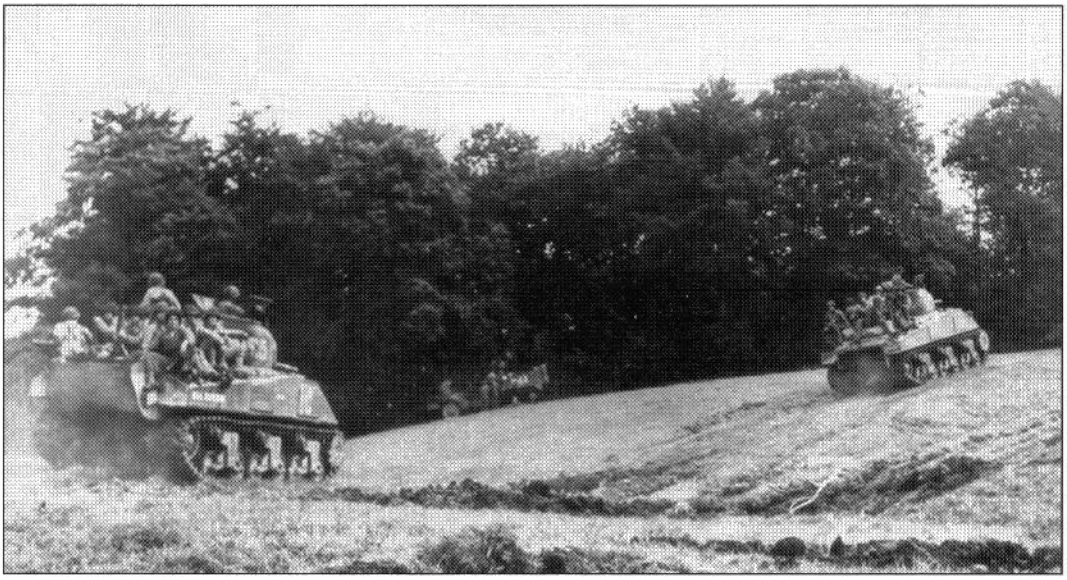


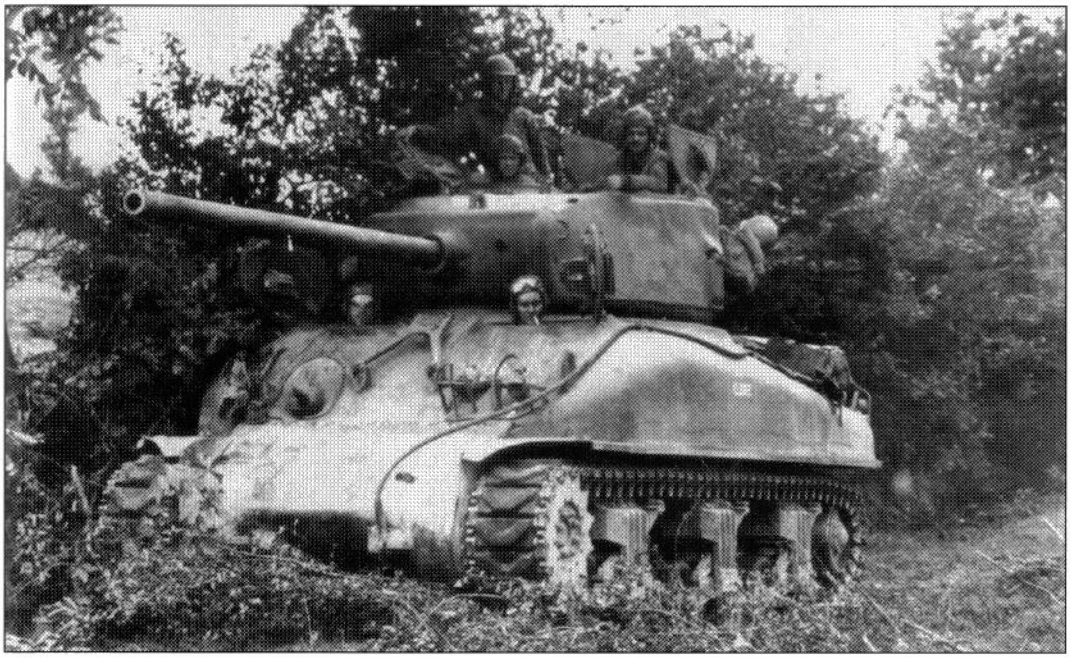
US infantry examine an abandoned 4.7cm PaK (t) auf Pz.Kpfw. Renault 35.R (f). This tiny tank destroyer consisted of a Czechoslovak 47mm anti-tank gun mounted on a turretless French Renault 35.R infantry tank. About 110 of these were in service during the Normandy fighting, and they were still capable of disabling a M4 medium tank from ambush. (US Army)



The crew of a M8 75mm HMC named "Laxative" of the 3rd Armored Div. prepare their vehicle for combat on 9 August 1944 during the fighting with the 2.Pz.Div and 1.SS-Pz.Div around Mortain. Notice that the vehicle is fitted with a Culin hedgerow cutter on the bow. The M8 was an assault gun version of the M5A1 light tank, substituting an open-topped turret with 75mm howitzer for the usual 37mm gun turret. They were deployed in armored infantry battalions for fire support in place of the older T30 75mm HMC after 1943. (US Army)

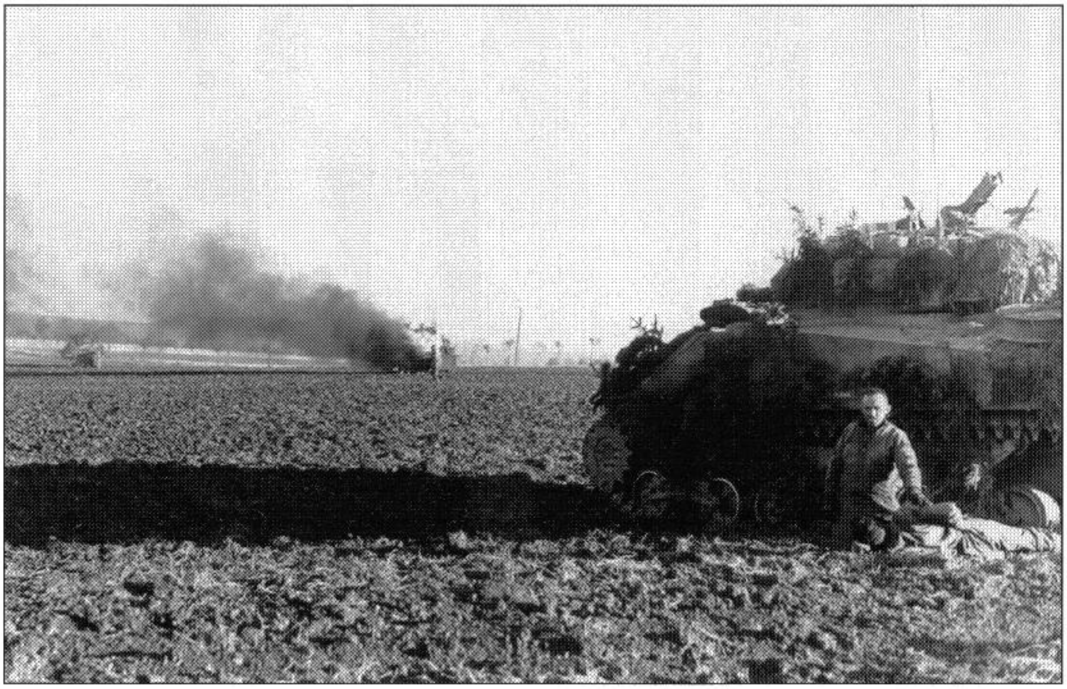
The 33rd Arm'd Regt., 3rd Arm'd Div. advanced from Reffuville towards Juvigny on 7 August 1944. The trailing M4 is still fitted with its deep wading trunk, over six weeks after the division landed in France. Elements of the 3rd Armored were committed to containing the German Mortain counter-offensive, and fought with elements of the 2.Pz.Div and 1.SS-Pz.Div. in the area through much of mid-August. (US Army)

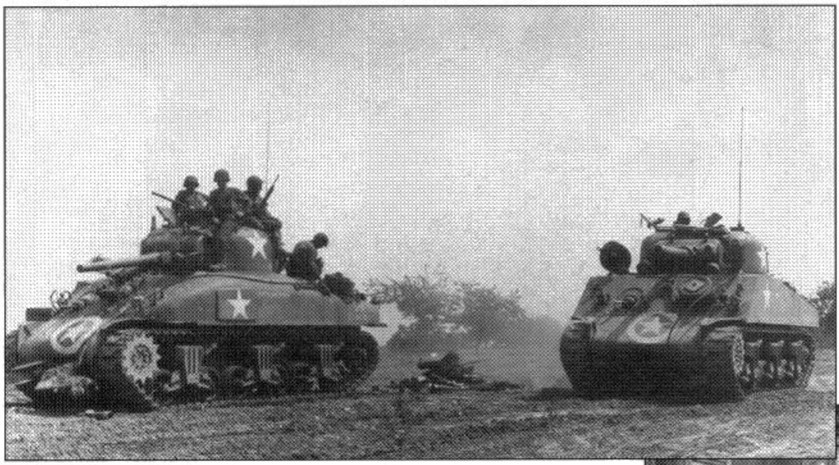




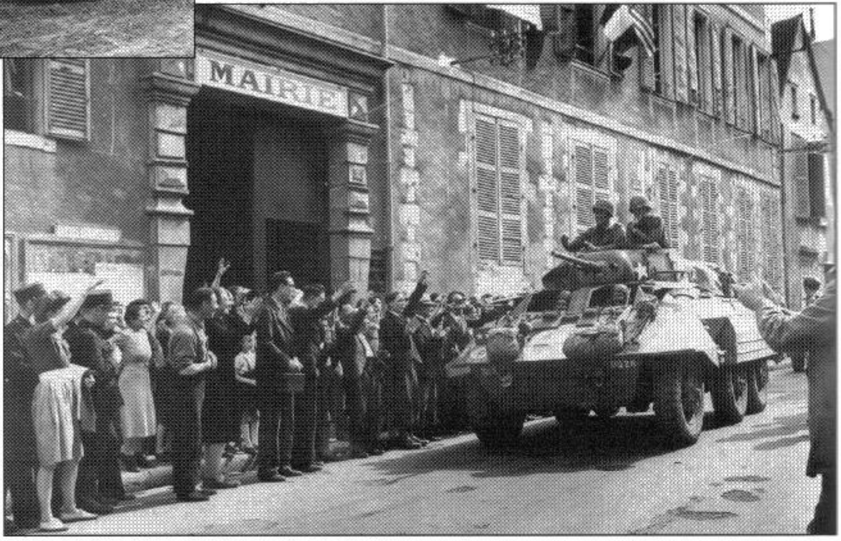
A M4A1 (76) W of the 2nd Armored Div. moves alongside a hedgerow near Champ-de-Bouet on 10 August 1944. There were about 300 of the 76mm Shermans available around the time of the Normandy invasion, but they did not become a common type until the late summer 1944. The 76mm tank gun was not as effective as the British 17 pdr., but was chosen due to the availability of 76mm ammunition, which was already in use on the M10 tank destroyer, 3 inch anti-tank gun, M18 Hellcat tank destroyer and naval guns. (US Army)

Although the US Army drive towards the Seine in mid-August was not as vigorously opposed as the June-July bocage fighting, the Germans did not retreat without a fight. Here, a pair of M4 medium tanks, probably from 4th Arm'd Div., have been knocked out near Bayon. In the foreground, a tanker awaits a medic while one of his fellow crewmen lies alongside the tank, wounded. (US Army)

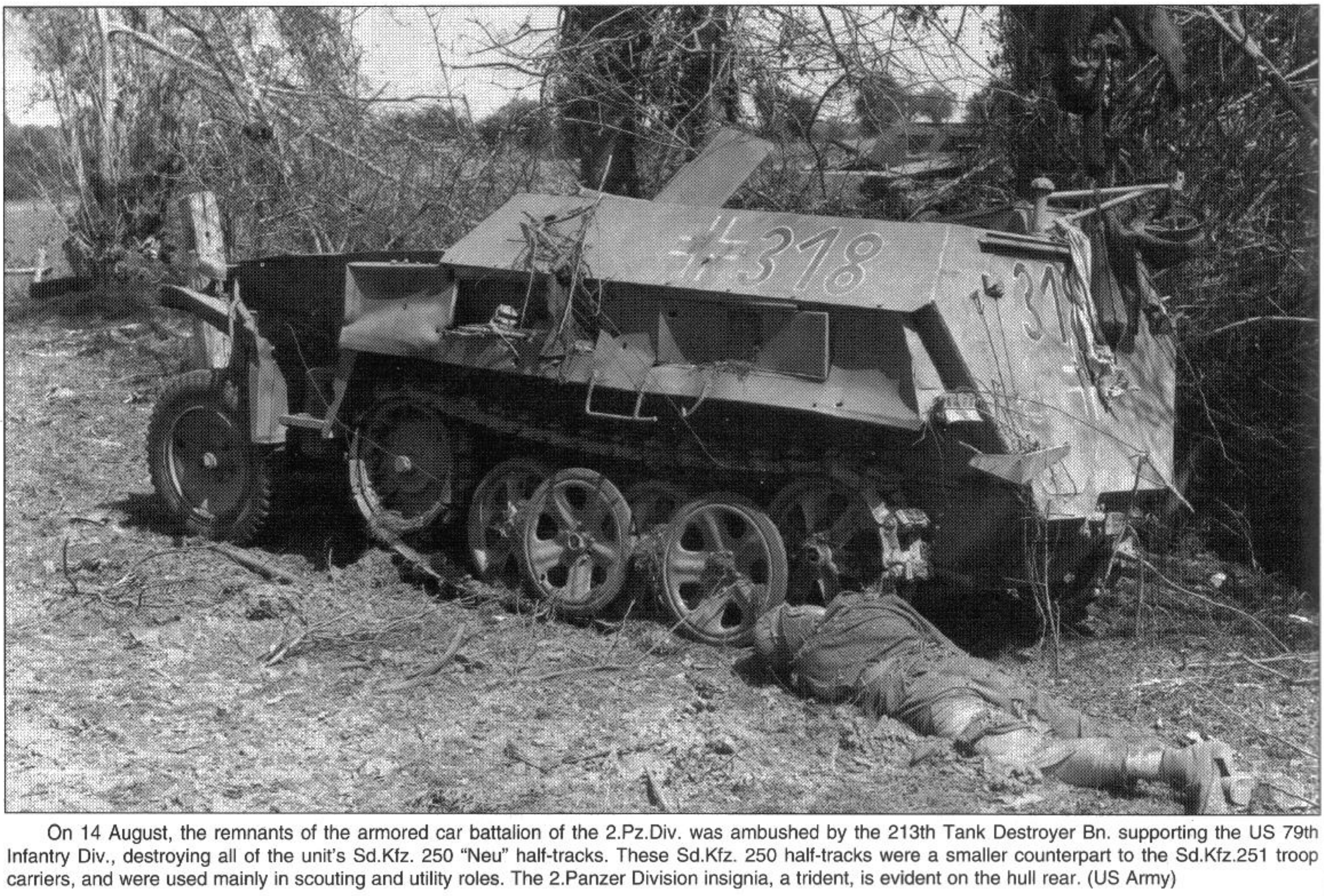




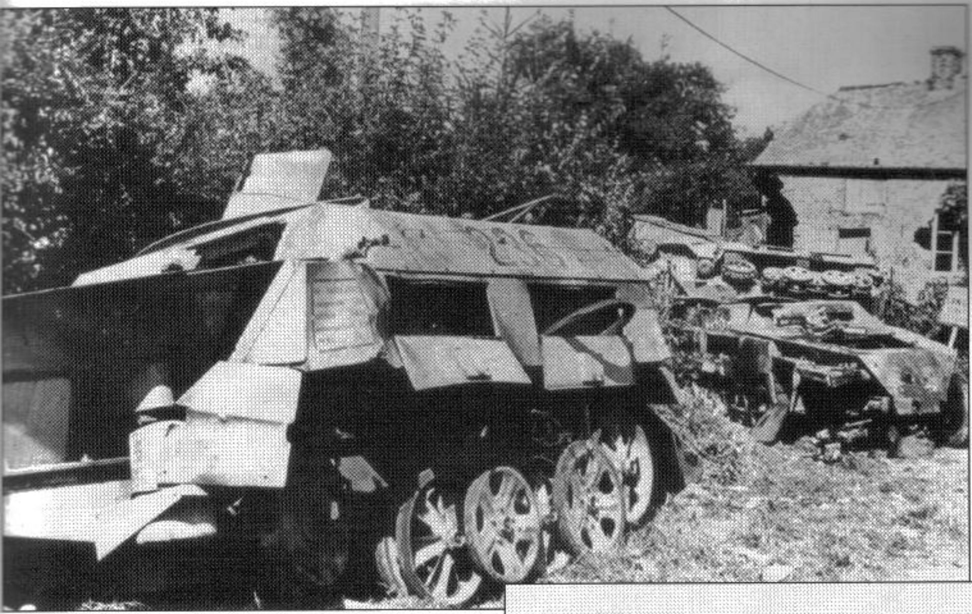
During the exploitation phase that followed Operation Cobra, the US Army began committing fresh armor into the battle. Here, tanks of the 31st Tank Bn., 7th Arm'd Div. move forwards nears Chartres on 16 August. The M4A1 medium on the left, named "Battlin' Bitch" is fitted with the Culin hedgerow cutters. The tank on the right is a M4 105mm howitzer tank, a relatively new type that appeared two weeks after the Normandy landing. This was used in headquarters companies of the tank battalions to provide additional artillery fire support for armored operations. (US Army)



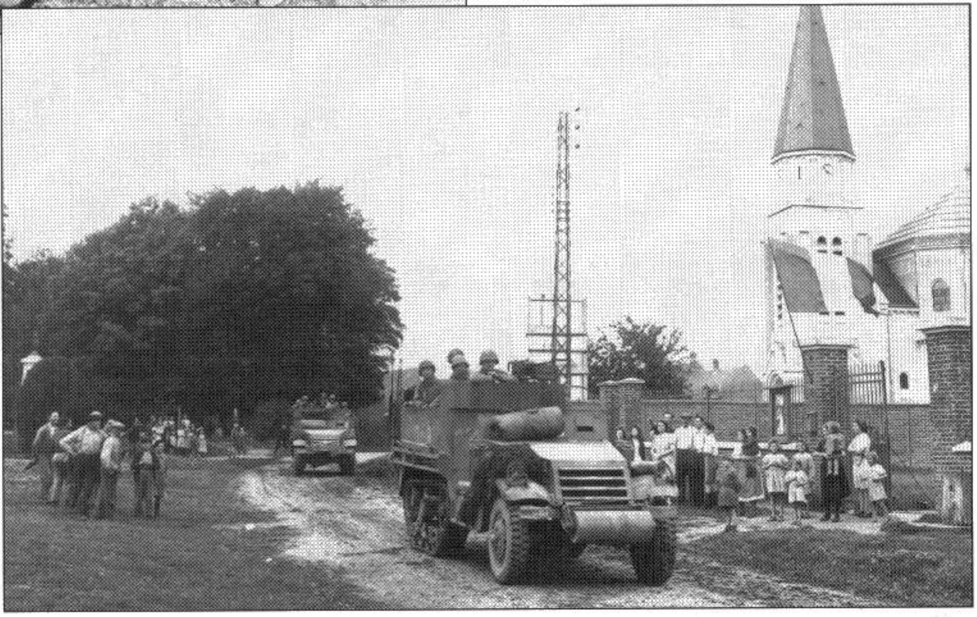
Maj. Gen. L. Silvester, the commander of the US Army 7th Armored Division, receives a warm reception in front of the mayor's office in Chartres after the city was liberated in August 1944. He is driving in one of the headquarter company's M8 armored cars. (US Army)



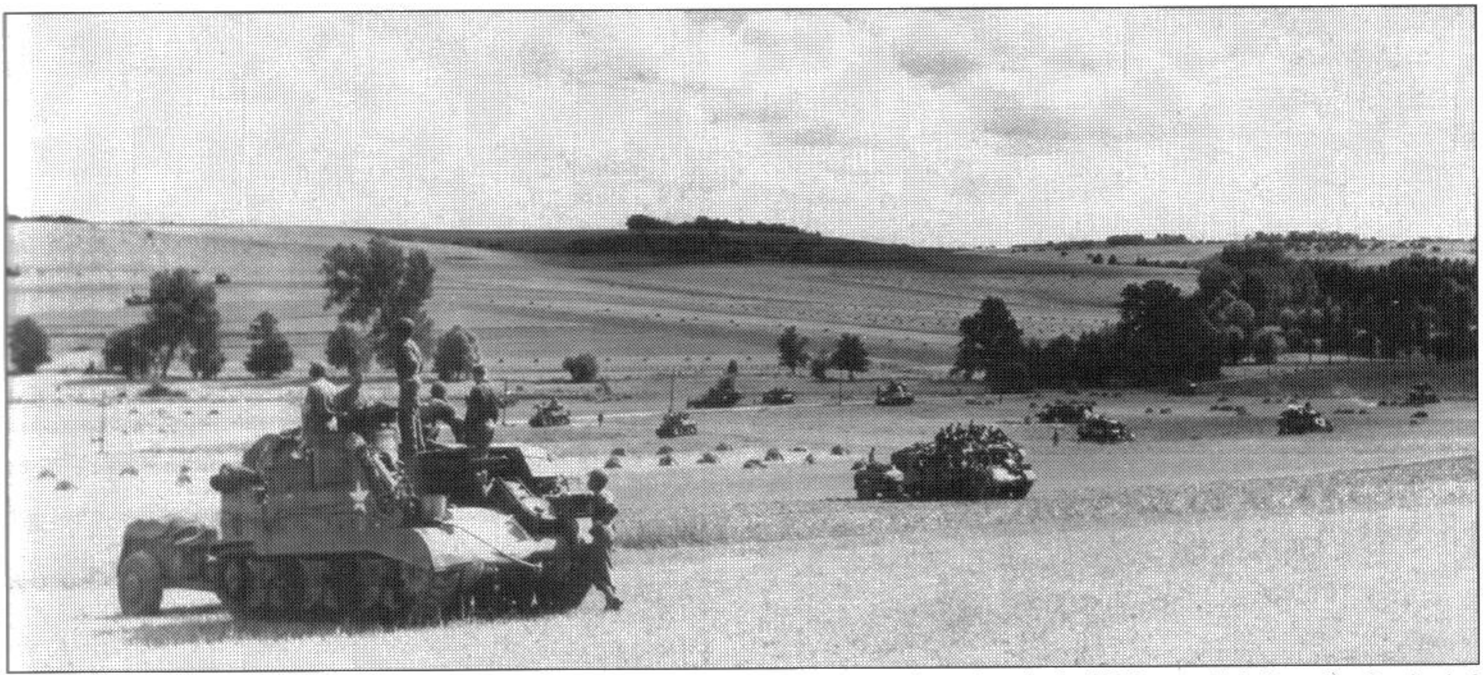
On 14 August, the remnants of the armored car battalion of the 2.Pz.Div. was ambushed by the 213th Tank Destroyer Bn. supporting the US 79th Infantry Div., destroying all of the unit's Sd.Kfz. 250 "Neu" half-tracks. These Sd.Kfz. 250 half-tracks were a smaller counterpart to the Sd.Kfz.251 troop carriers, and were used mainly in scouting and utility roles. The 2.Panzer Division insignia, a trident, is evident on the hull rear. (US Army)



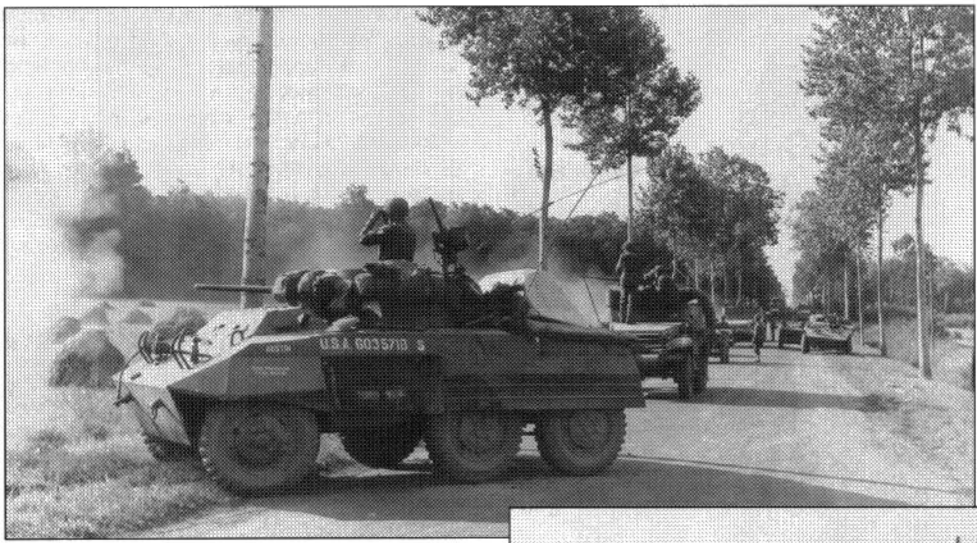
Another view of the knocked out half-track armored car unit from the 2.Pz.Div. on 14 August. As is evident in this view, the vehicle to the right was destroyed by two anti-tank gun penetrations on the bow plate. The vehicle in the foreground, from the 2nd company, has apparently taken several hits including one near the driver's visor. (US Army)



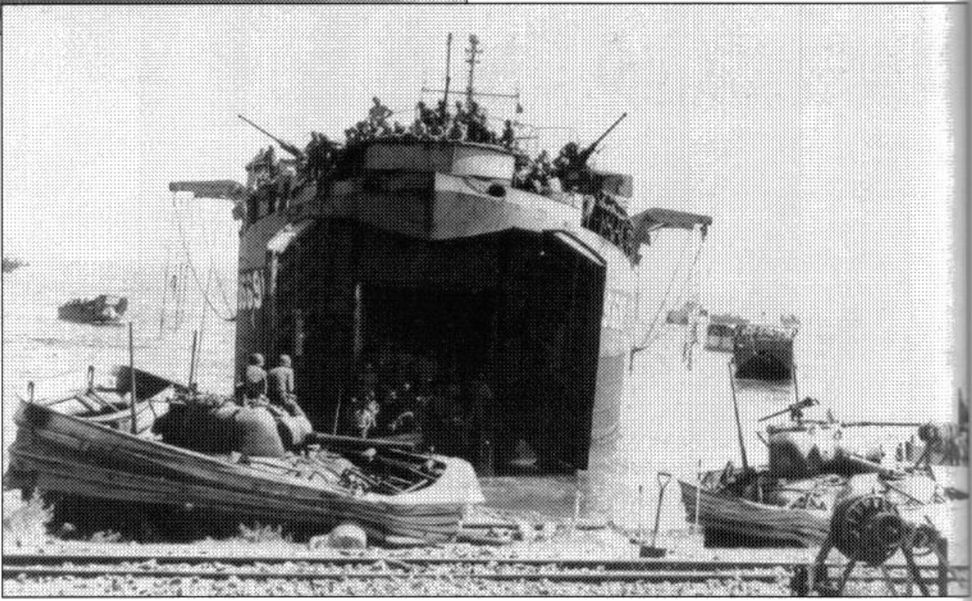
A M3A1 half-track personnel carrier named "Daring" from D Company, 41st Infantry passes through Catigny, France on 31 August. Cantigny was a familiar name to many US Army officers, who had fought there in 1918 during World War I. This is an older M3 half-track fitted with the original pattern headlights that has been brought up to M3A1 standards with the addition of the machine gun ring mount, external mine racks, and other improvements. (US Army)



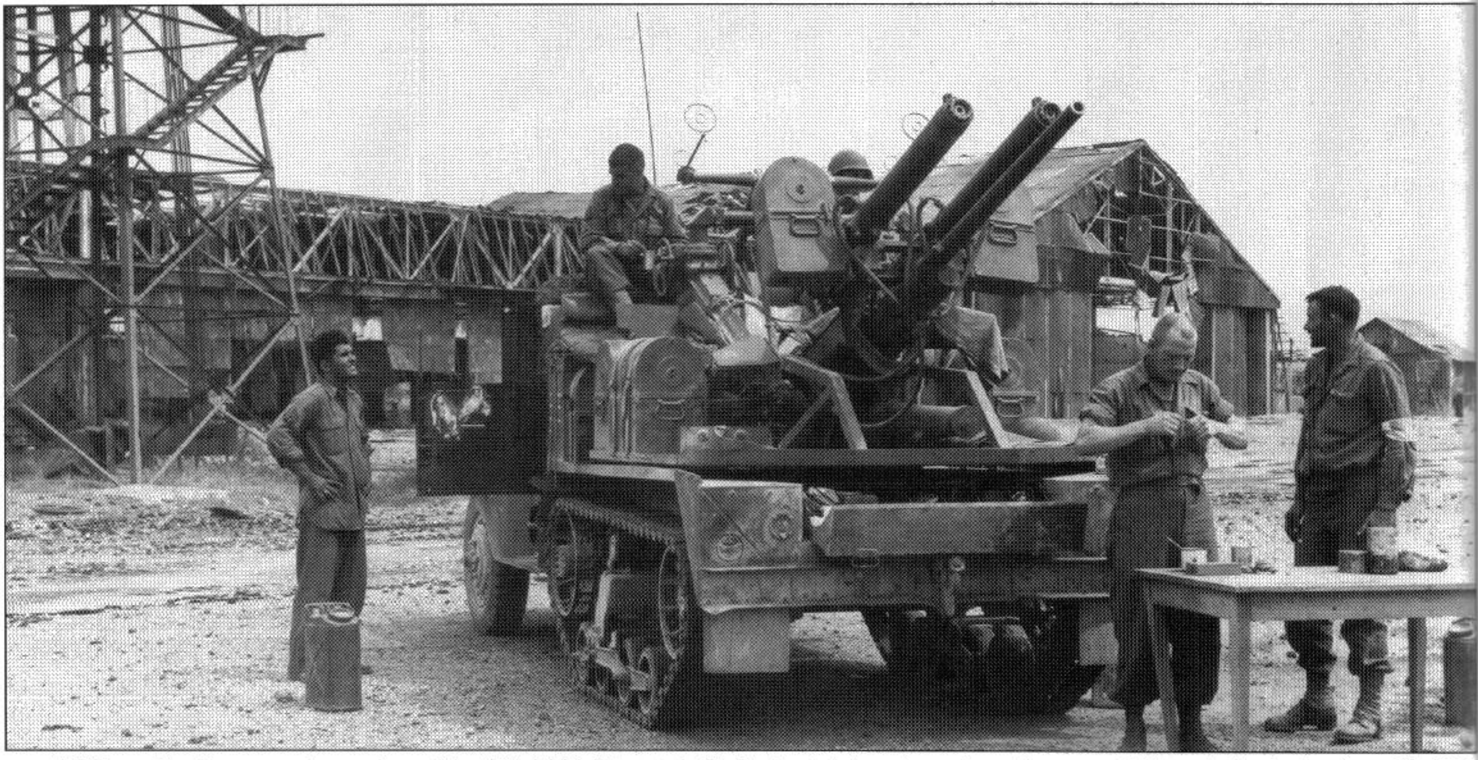
In sharp contrast to the restrictive terrain of the bocage country in Normandy, Operation Cobra brought the US Army out into the rolling farmland of northwest France, as is so evident in this view from 20 August 1944. Closest in view is a pair of M7 105mm HMCs towing ammunition trailers. In the background is a M5A1 light tank company, probably assigned to provide security while the field artillery battalion prepares for a fire mission. (US Army)



The Normandy campaign saw the combat debut of the M8 armored car, seen here during an engagement with Co. A, 23rd Infantry, 7th Arm'd. Div. near Epirnay on 27 August. The M8 armored car was used in recon and HQ units along with its unarmed utility variant, the M20 armored car, an example of which can be seen further down the column. The M8 was armed with a 37mm gun which proved adequate, since the M8 was not designed to fight enemy tanks. (US Army)

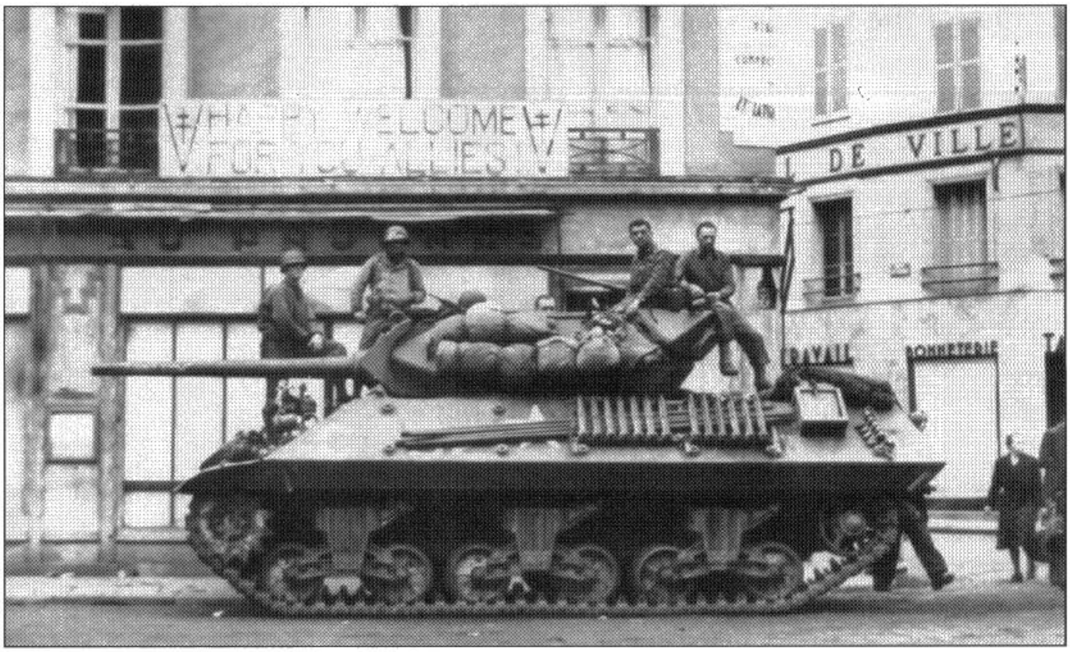


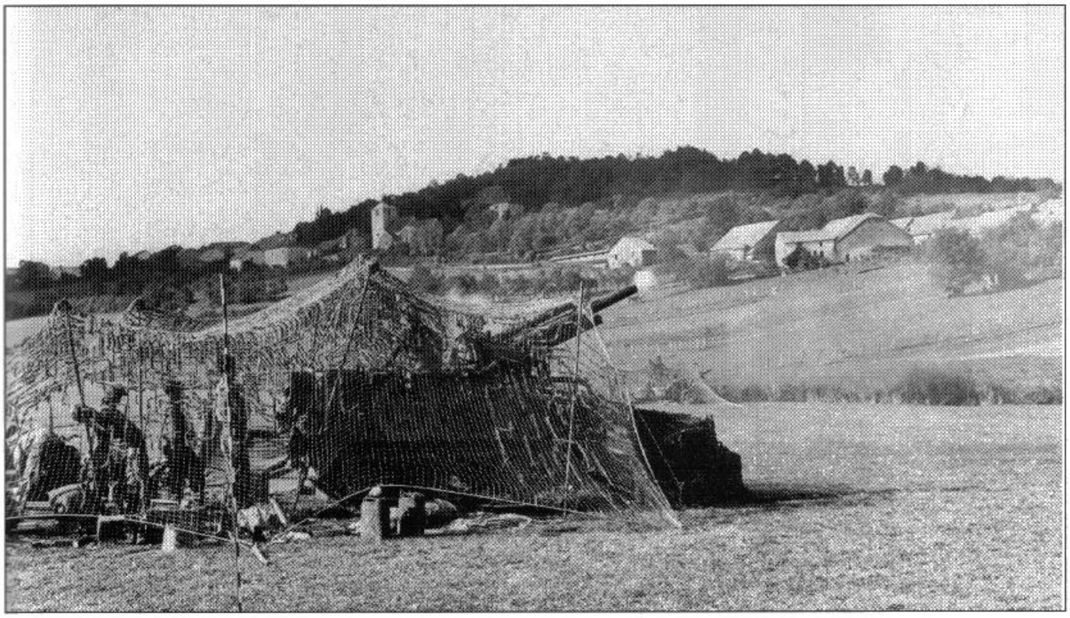
During the course of the US Army drive in northwest France, US and French forces in the Mediterranean staged Operation Dragoon, an amphibious landing on the coast of the Riviera in southern France on 15 August 1944. Here, a pair of M4A1 Duplex Drive tanks sit along the coast as an LST arrives to disgorge its cargo. The landings in southern France went like clockwork, with little opposition from the Germans who had their attention concentrated elsewhere. (US Navy)



A T28 combination gun motor carriage of the 443rd AAA Bn. guards St. Rapheal air base in southern France on 17 August after the landings. The T28 was an expedient anti-aircraft vehicle rushed into service for the North African landings in 1942. A small number remained in service in the Mediterranean theatre, but in northwestern France, it had been replaced by the improved M15 and M15A1 CGMCs. (US Army)

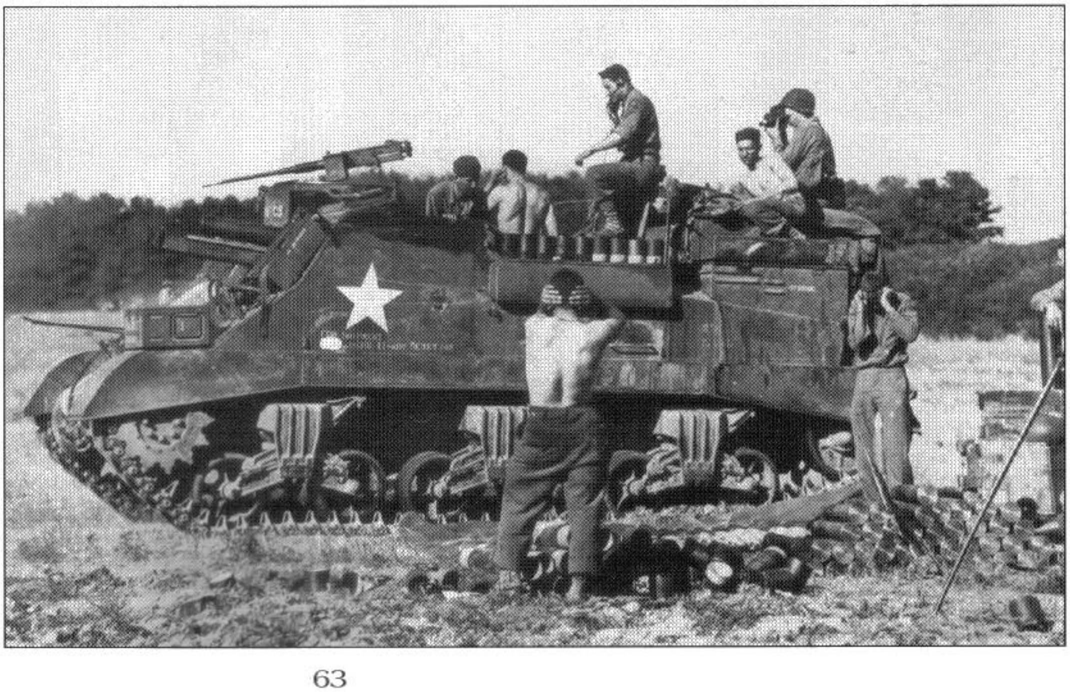
A M10 tank destroyer crew awaits further orders after having landed in southern France on 15 August. The southern landings forced the German Wehrmacht to withdraw much of its forces from Central France for fear of having them cut off by the converging Allied spearheads. (US Army)



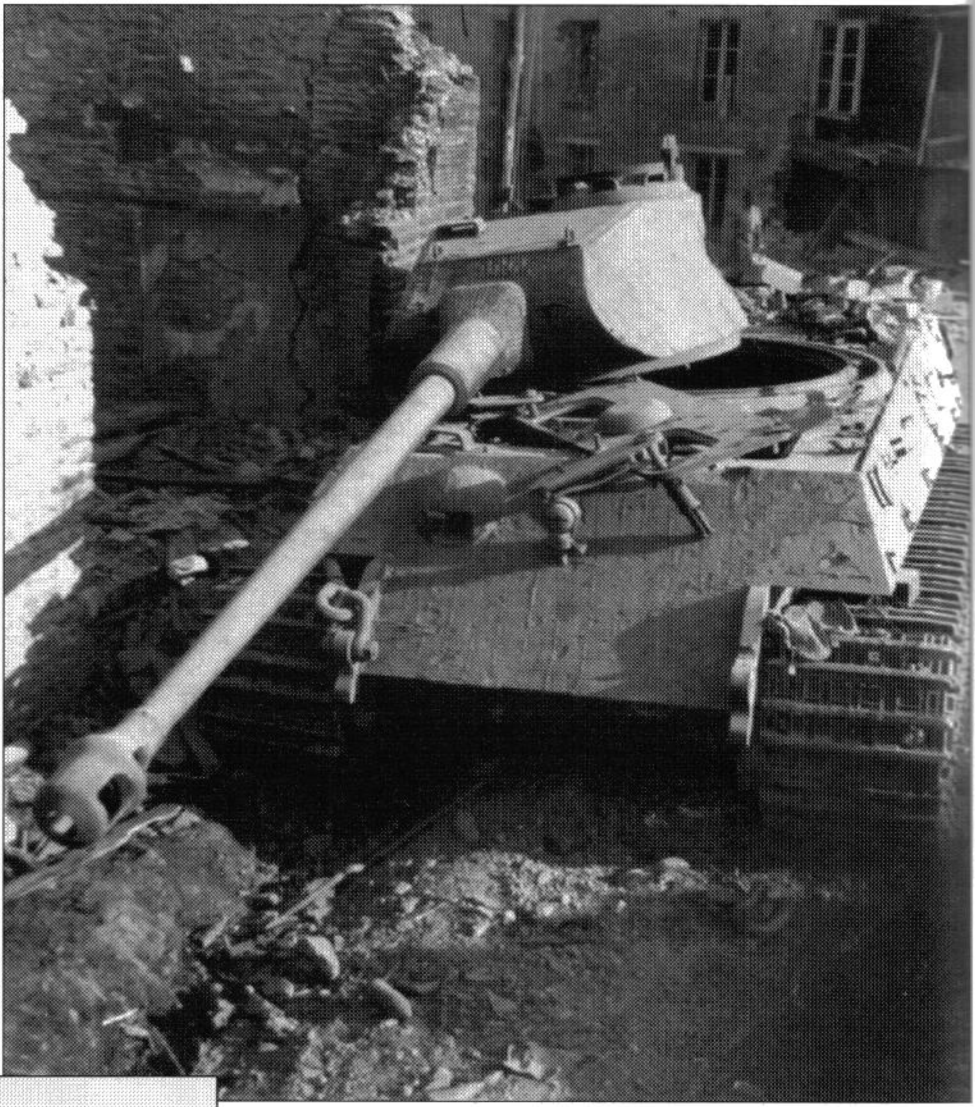


A T19 105mm HMC fires in support of advancing Allied forces in southern France in August 1944. The T19, a self-propelled mount consisting of a M3 half-track and 105mm howitzer, was obsolete by this stage and had been replaced in most units by the M7 105mm HMC. However, it still lingered in service in the Mediterranean theatre, where most of the units deployed in southern France originally served. (US Army)

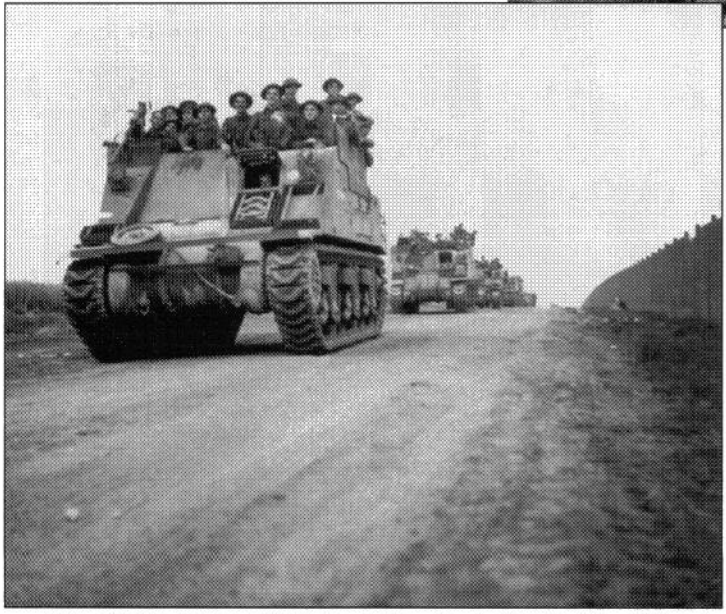
The standard US Army self-propelled howitzer in 1944 was the M7 105mm HMC, seen here on a fire mission on 20 August. It was based on the M4 medium tank chassis, a more adequate chassis than the light M3 half-track used by the older T19 HMC. (US Army)



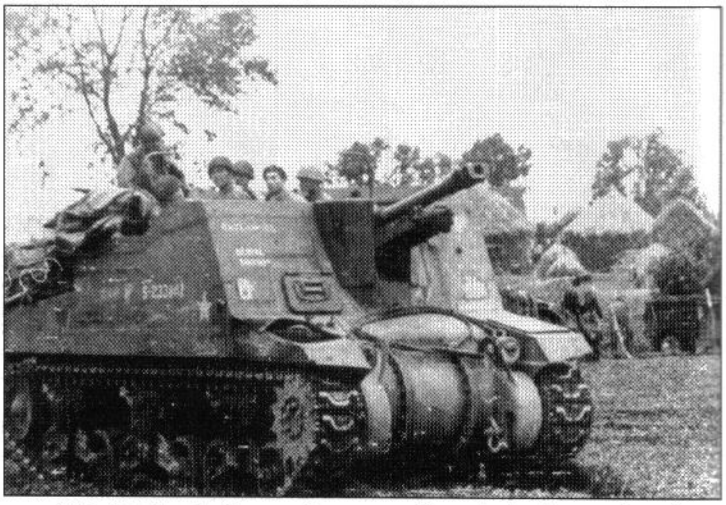
Battle for the Falaise Gap



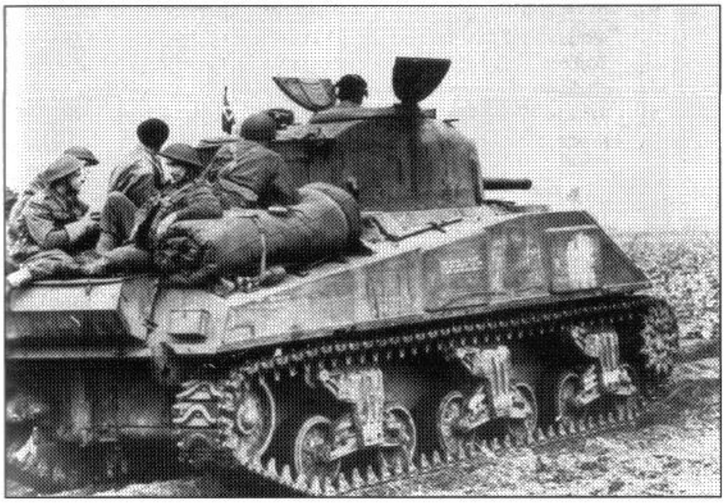
On 6 August, the town of le Plessis Grimoult, to the east of Mt. Pincon, was taken in a day-long hand-to-hand battle by the British 130th Brigade. Among the debris in the city was this King Tiger of s.Pz.Abt. 503. The tank has obviously suffered from an internal explosion which has knocked off its turret. It is unclear how this tank was knocked out; some sources indicate it was hit by rocket fire from a Typhoon. The King Tiger was the heaviest tank to see combat in Normandy, but it was new and suffered from serious technical shortcomings. Only two companies of this new tank were committed to the fighting, and all were lost by the end of August.



The stinging losses of infantry in the July fighting led the British to develop more satisfactory means to transport the forward waves of infantry. During the attack towards Falaise beginning on 8 August, Operation Totalize, the first use was made of improvised armored troop carriers, variously dubbed "holy rollers" or "defrocked priests". The names of course stemmed from the use of M7 Priest self-propelled howitzers for the conversion. By this time, the Royal Artillery was standardizing on the Sexton 25 pdr., so the Lend-Lease M7 Priests were converted to this role by removing the howitzer and adding bench seats. A similar conversion was made later using surplus Canadian Ram tanks, resulting in the Ram Kangaroos. (The Tank Museum)

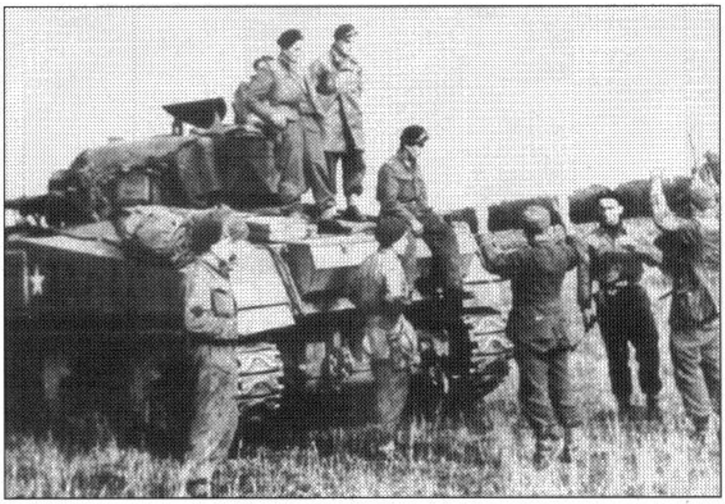


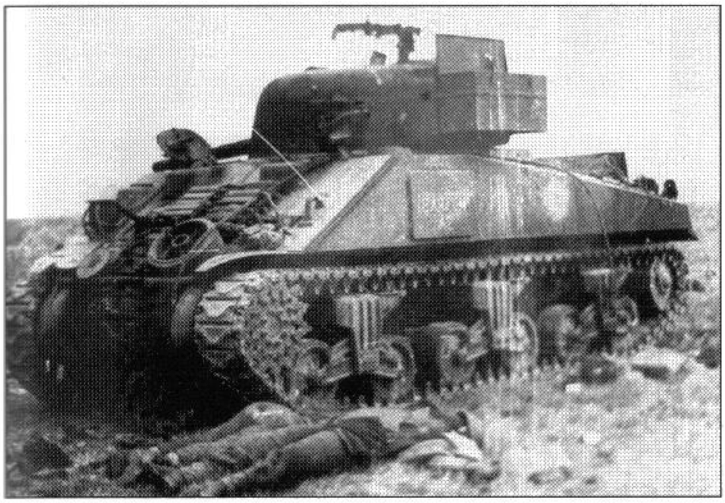
A Sexton 25 pdr. fires on German positions during the opening phase of Operation Totalize on 8-9 August 1944. The Sexton was the British equivalent of the US Army's M7 105mm HMC, but used the standard British 25 pdr. instead. This is a vehicle of the 1st Polish Armoured Division named "Raclawice" after the famous 18th Century battle where Tadeusz Kosciuszko led a peasant army to defeat the Tsarist Russian forces. (Sikorski Institute)



A Sherman V of the 1st Polish Armoured Division moves forward towards Falaise during Operation Totalize. The Polish 1st Armoured Div. and the Canadian 4th Armoured Div. were the spearheads of the British drive, due to the heavy losses that the three British armoured divisions had suffered during the fighting around Caen in July. Notice that the Allied star insignia has been painted over on this tank, as such insignia made attractive aiming points for German anti-tank gunners. (Sikorski Institute)

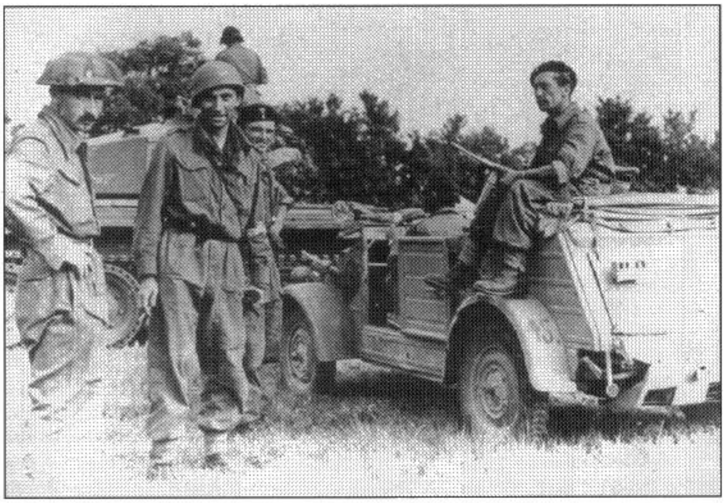
Polish tankers from the 24th Lancers interrogate German prisoners captured during the Falaise fighting. The Polish 1st Armoured Division managed to penetrate the furthest into the Falaise Gap, but the intensity of the German counter-attacks to keep the route of retreat open broke the Polish force into several isolated pockets. (Sikorski Institute)

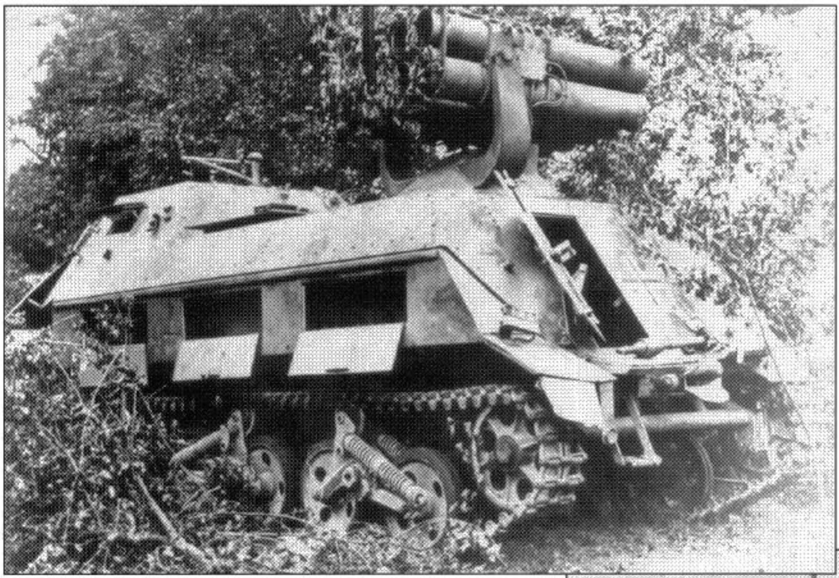




The Polish 1st Armoured Division eventually secured a position on Mount Ormel, north of Chambois, where they made a defensive stand against the mass of retreating German forces. The casualties in the division were extremely heavy as this photo attests. (Pilsudski Institute)

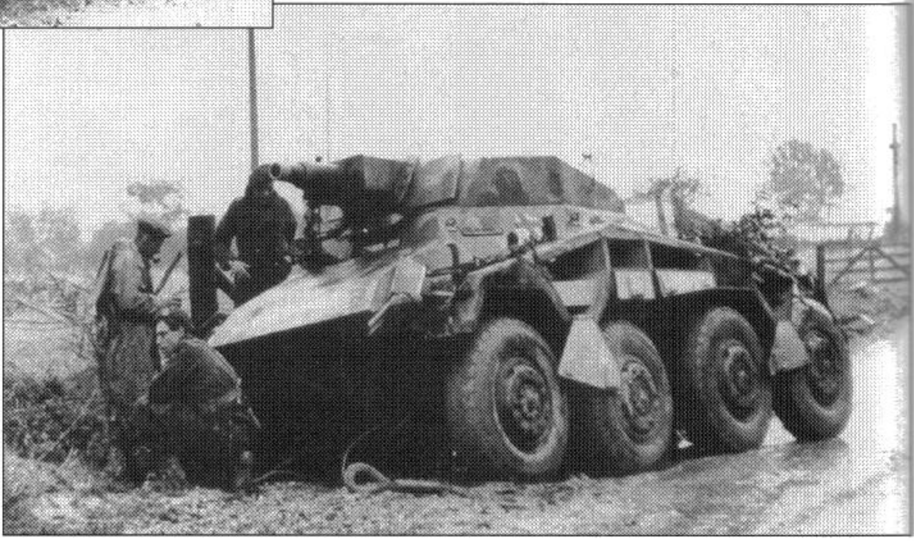
The Polish 1st Armoured Division put some German equipment back into service like this Volkswagen Kubelwagen seen here near a Crusader AA tank. The large number of Polish soldiers conscripted into the German army who were captured in Normandy by the Allies also gave the Poles a source of personnel to rebuild the 1st Armoured Division after the heavy losses suffered in the Falaise Gap battles. (The Tank Museum)

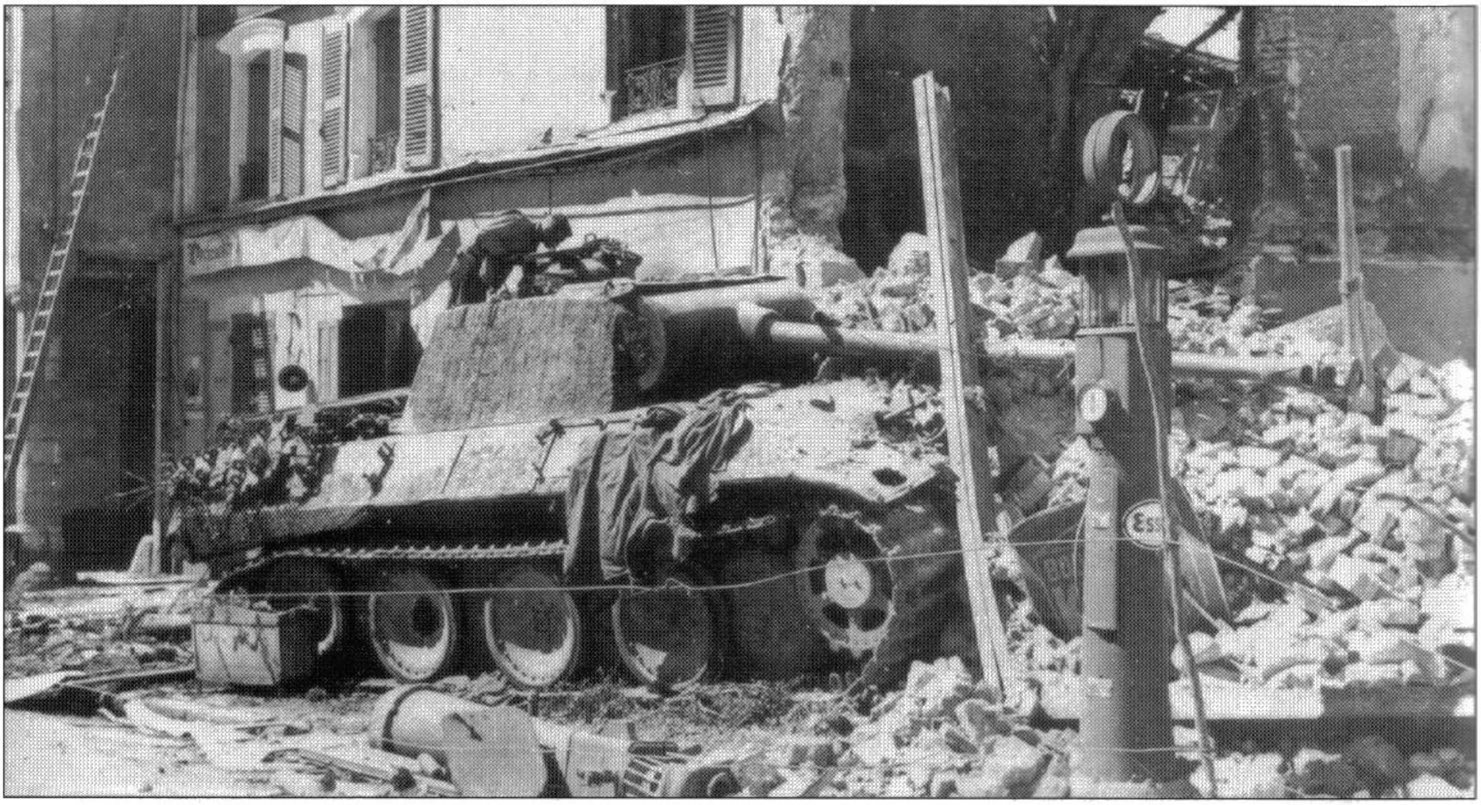




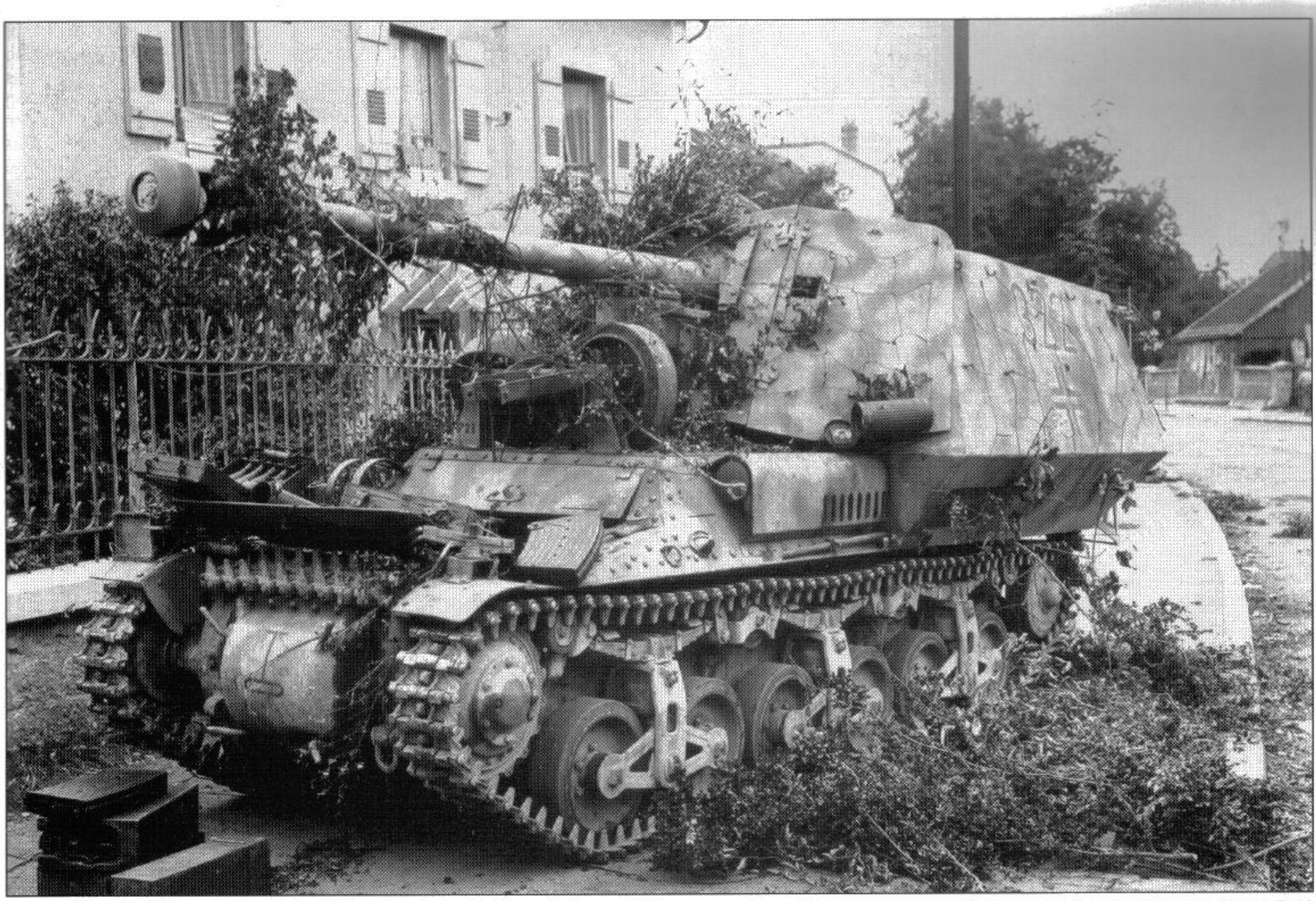
The Falaise Gap was filled with abandoned or destroyed equipment that had to be left behind by the retreating German forces. This is a 15 cm Panzerwerfer 42 auf SF (Sd.Kfz. 4/1), a 105mm multiple rocket launcher based on an armored version of the Opel Maultier half-track truck. (US National Archives, Federal Records Center-Suitland)

An abandoned Sd.Kfz. 234/3 s.Panzerspahwagen (7.5cm) of the 116.Panzer Div. is inspected by British troops. This was a howitzer-armed version of the Puma armored car, and a platoon of six of these were attached to the heavy armored car companies of the panzer divisions for additional fire support. (The Tank Museum)



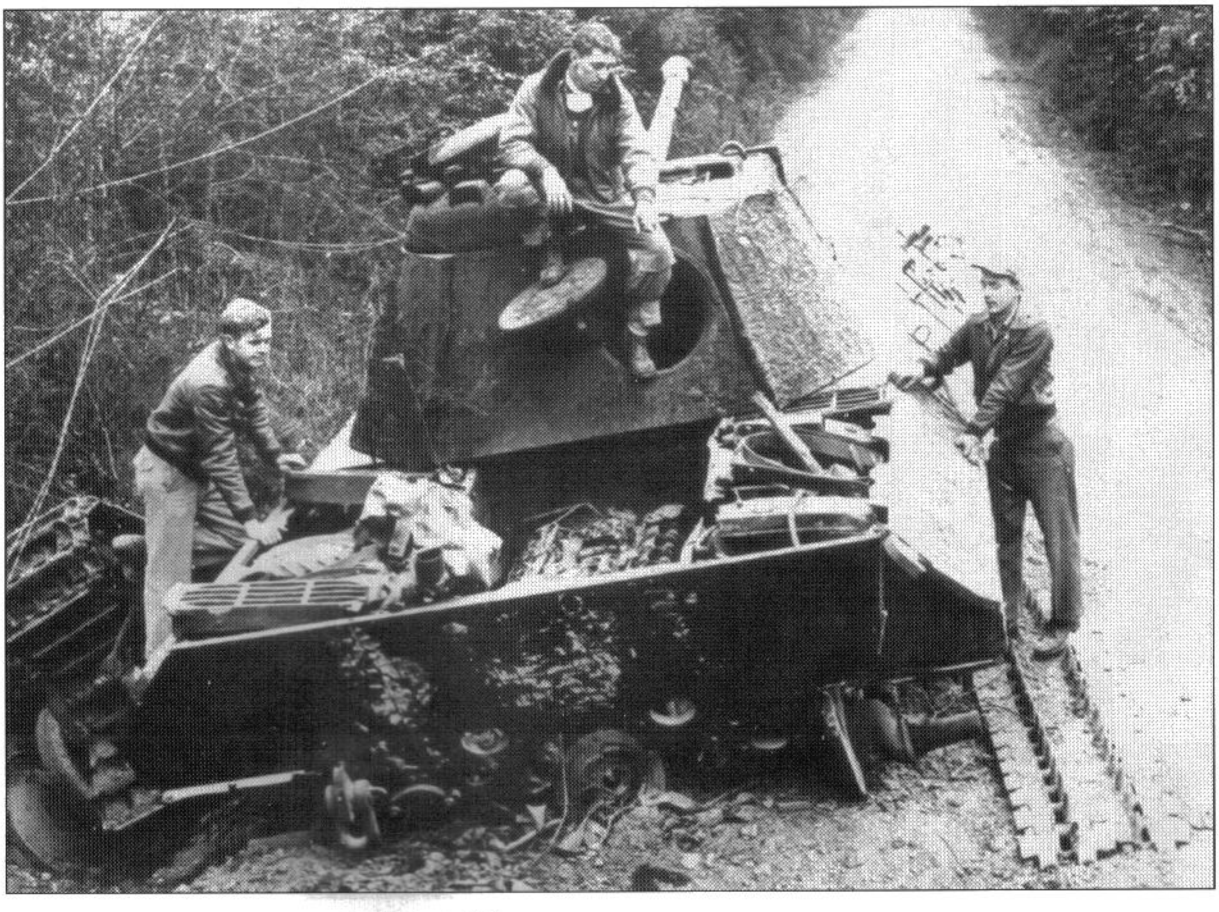


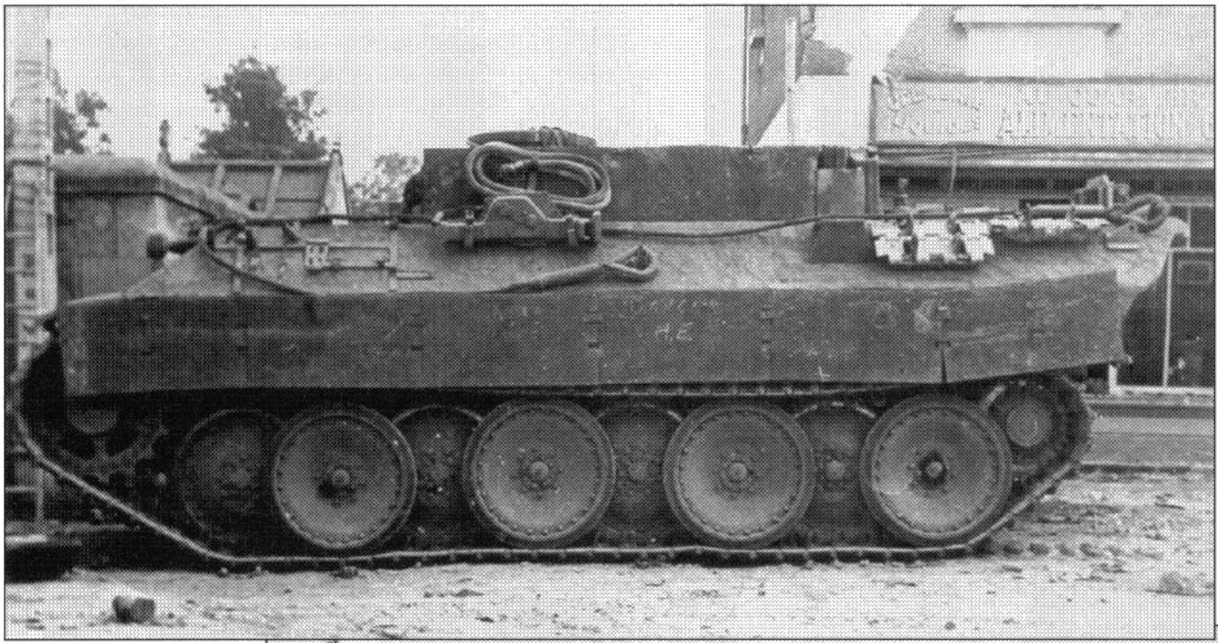
A US ordnance officer inspects a Panther Ausf. A lying abandoned in a shattered French town in August 1944. The German army lost over 400 Panther tanks during the Normandy fighting, most of them the standard Ausf. A version as seen here. (US Army)



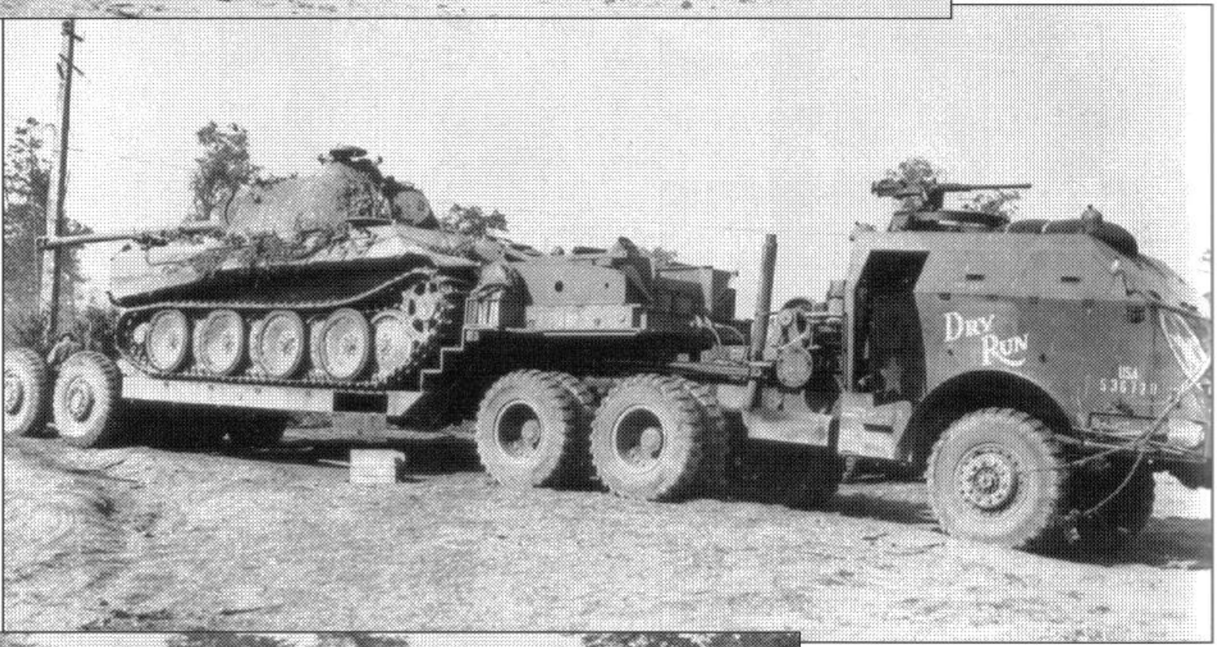
A 7.5cm PaK 40 auf Chenillette (f) lies abandoned in Vesoul, France. This was another of the Becker conversions, consisting of a German 75mm PaK 40 anti-tank gun mounted on a captured Chenillete Lorraine armored transporter. The Chenillete Lorraine was a popular basis for such conversions, as they were nearly all brand new in 1940, and many had not even been issued to French troops. (US Army)

A Panther is inspected by a US Army Air Force team in the bocage country in August 1944. The US 9th and British 2nd Tactical Air Forces made very high claims of tank kills during July-August 1944, though later assessments based on the inspection of wrecks revealed that air attack accounted for only a tiny fraction of direct German tank losses. However, air attacks had an enormously demoralizing effect on German tank units, and their disruption of the transportation network put severe constraints on the strategic mobility of German armored units. (US Army)

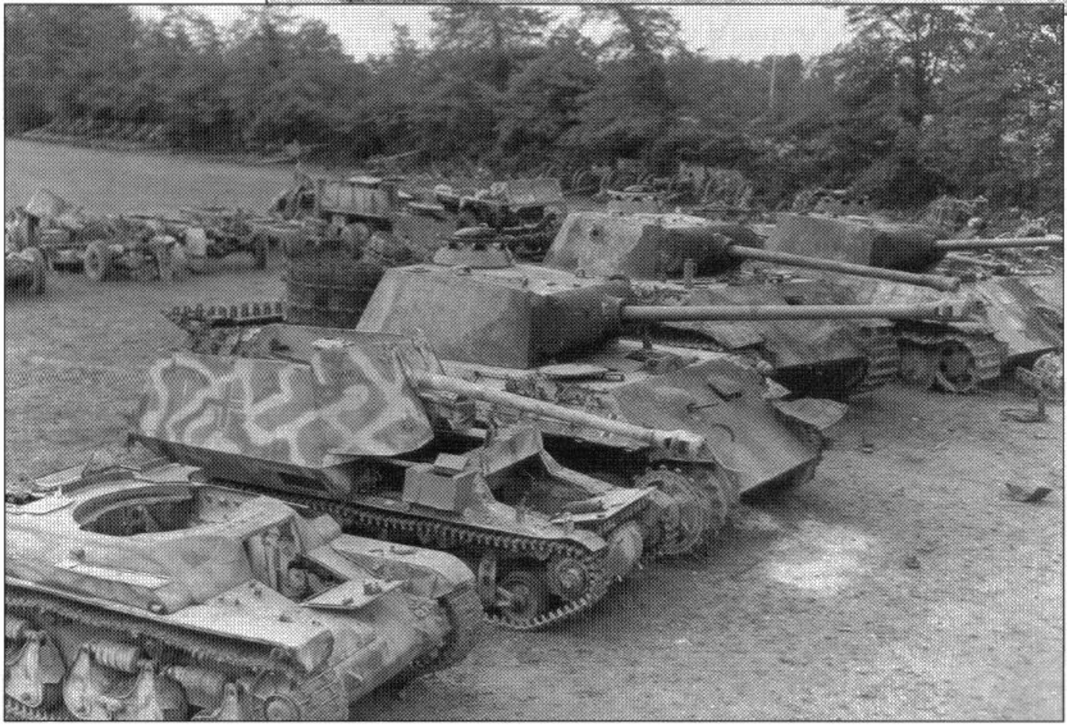




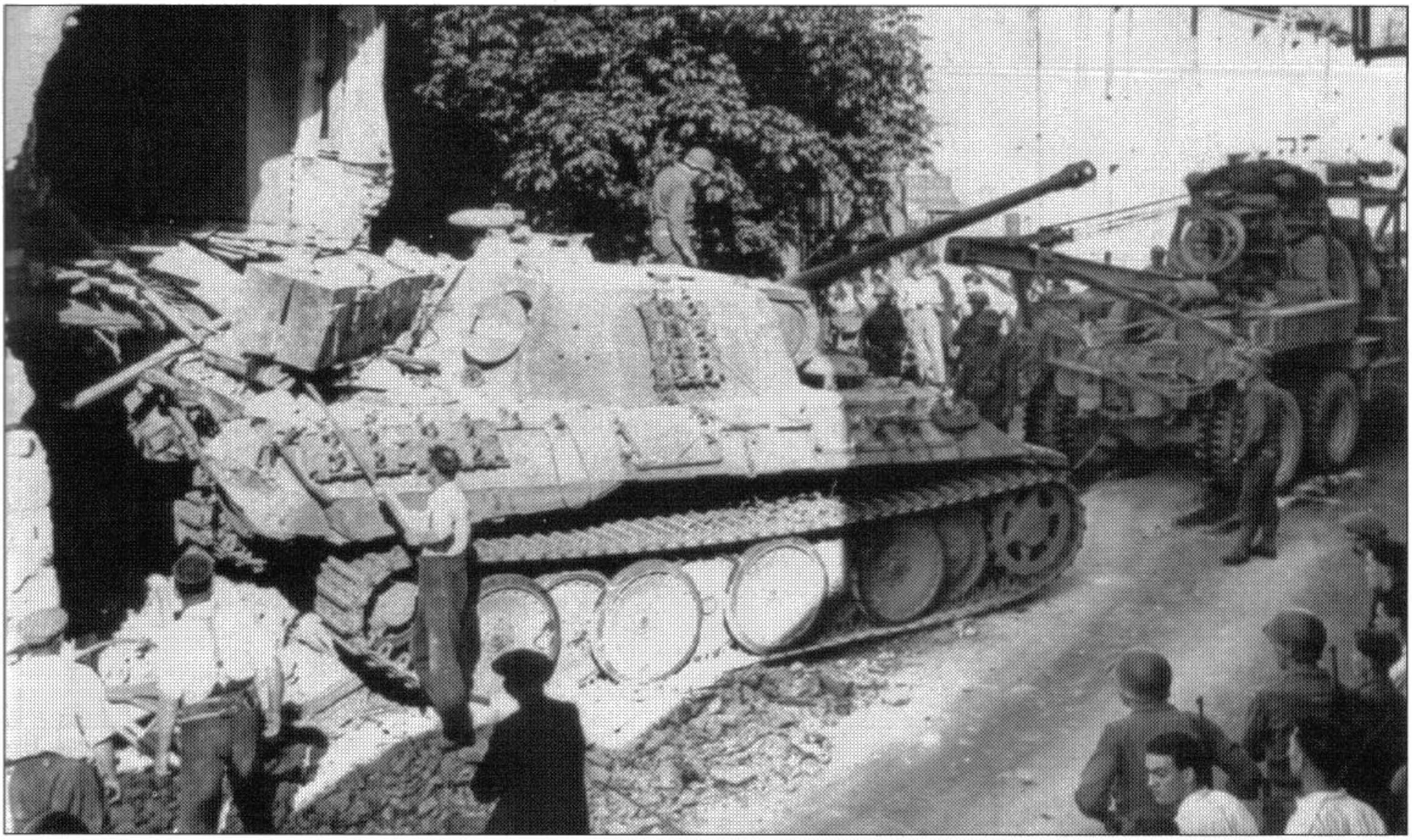
The Bergepanther was an armored recovery version of the Panther tank, fitted with a large winch in place of the turret. This abandoned Bergepanther captured by British forces is lacking the usual spade fitted at the rear, and was apparently being used in an improvised role as an ammunition carrier, hence the warning on the side of "Danger-H.E.". (The Tank Museum)



A number of relatively intact German Panther tanks were recovered by the Allied forces for further technical examination. This Panther is being driven away by a M25 Dragon Wagon, the standard US Army tank transporter. These were often used by Ordnance units in France to test out their vulnerability to new types of tank ammunition. (US Army)

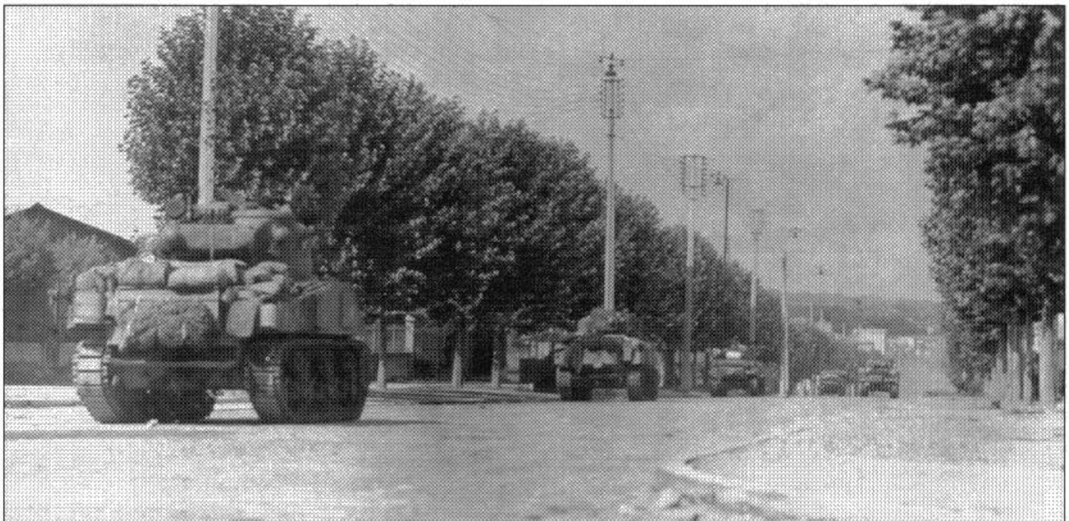


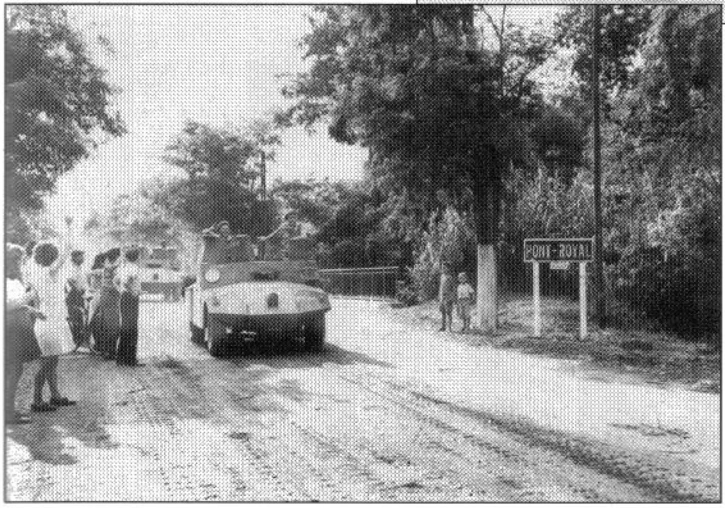
The US Army Ordnance set up a collection point for German armored vehicles for further technical inspection, this one being located south of Trevieres. To the left is a turretless French Renault 35.R, which from the fittings was formerly used as 4.7cm PaK (t) panzerjaeger. Beside it is a 7.5cm PaK 40 panzerjaeger on the Chenillette Lorraine chassis, and to the right are three Panthers. (US Army)



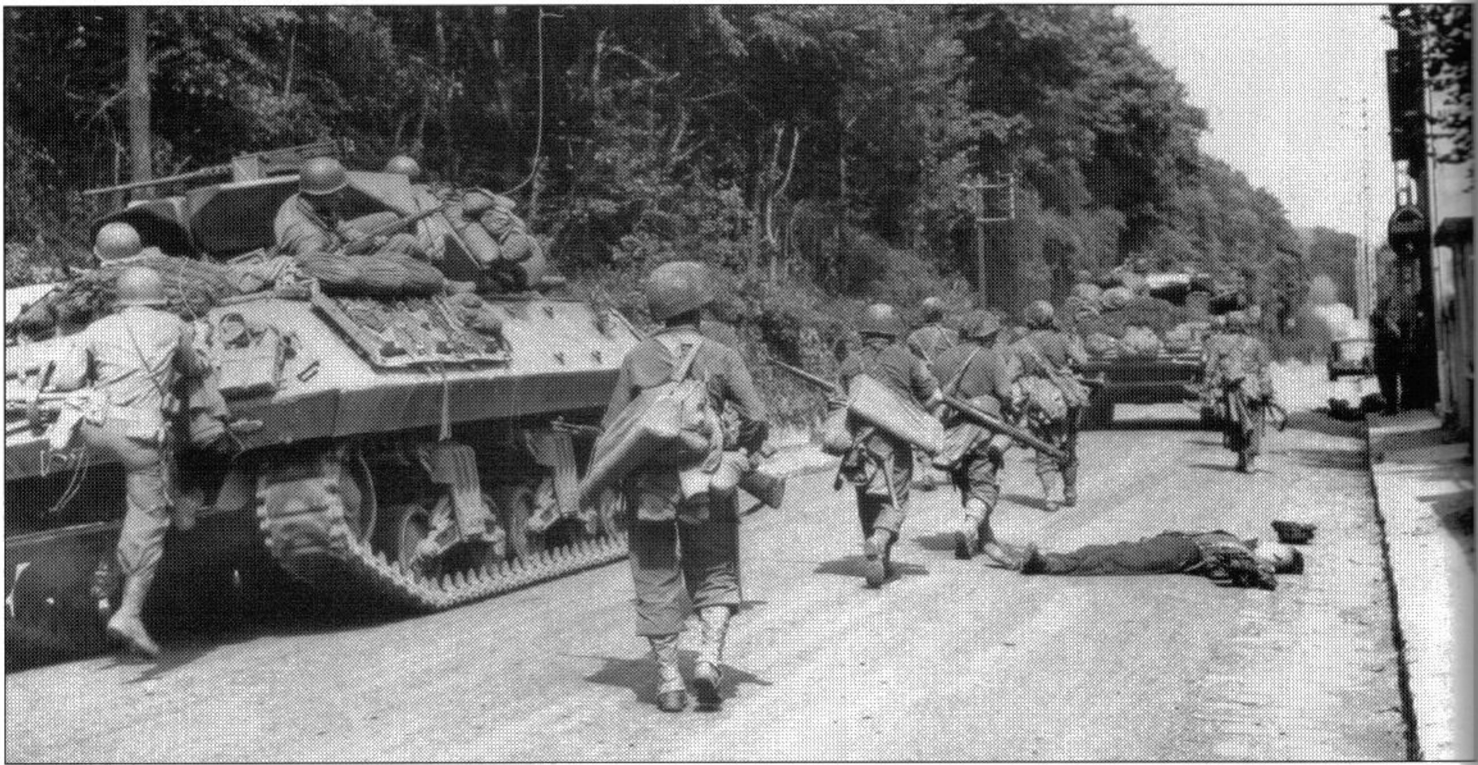
Troops of the French 2nd Armored Division recover a Panther Ausf. A tank that had come to grief in a small town near the Seine river in August 1944. The 2nd Armored Division landed in France in early August and was committed to the fighting in the middle of the month at the time of the battles around the Falaise Gap. (The Tank Museum)

With the German army in full retreat, Gen. Phillipe LeClerc won approval from General Eisenhower to dispatch the 2nd French Armored Division to liberate Paris. Here, on 25 August 1944, a tank column of M4A2 medium tanks fights its way into Anthony, a suburb of Paris about 5 miles to the west. (The Tank Museum)

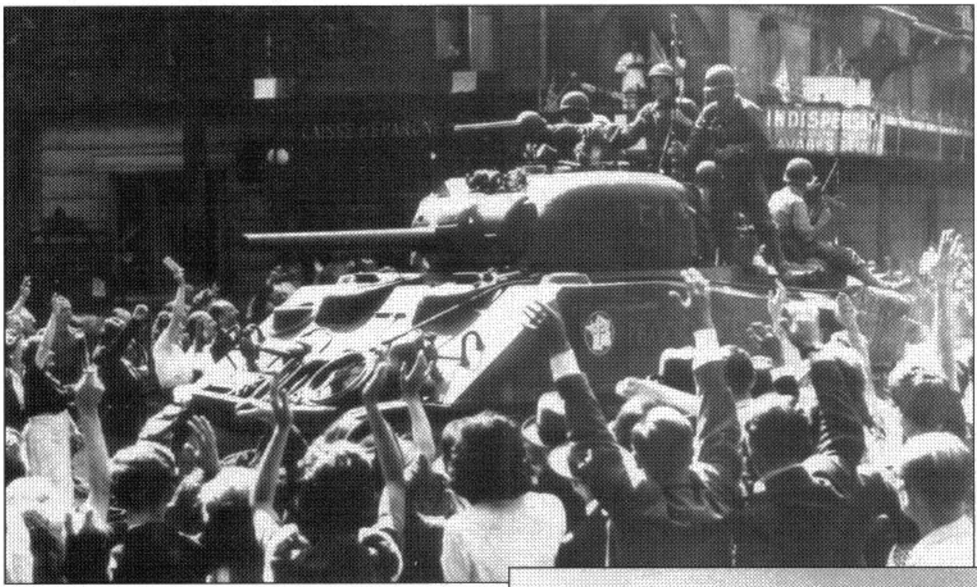




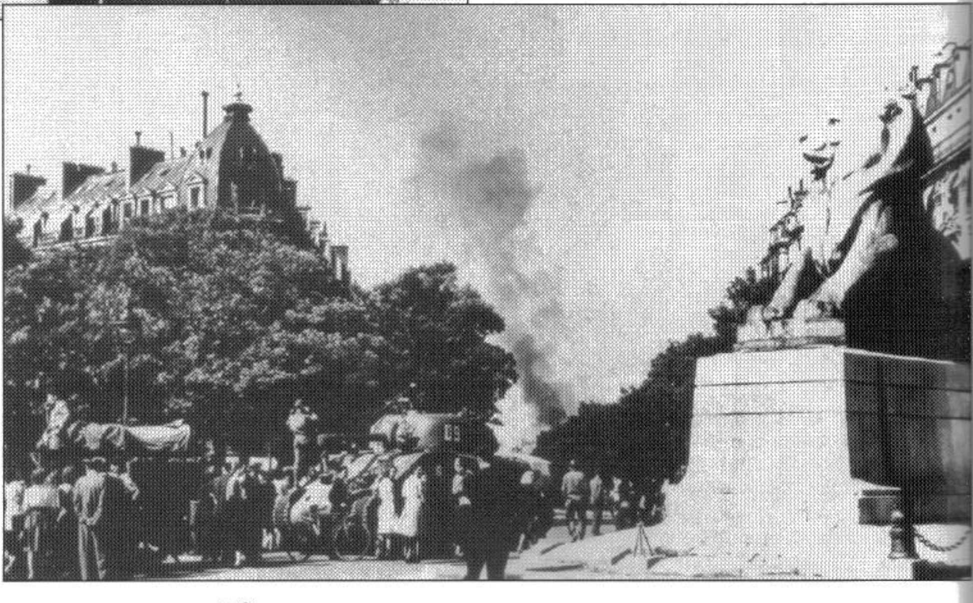
A column of Morris Mark II light reconnaissance cars, led by a car named "Grumpy" enters Pont-Royal near the Seine river on 23 August 1944. This particular vehicle was apparently being used by RAF forward observers supporting the 2nd Tactical Air Force. Light recce cars like the Morris were armed only with a single machine gun for self-defense since their role was scouting. (The Tank Museum)



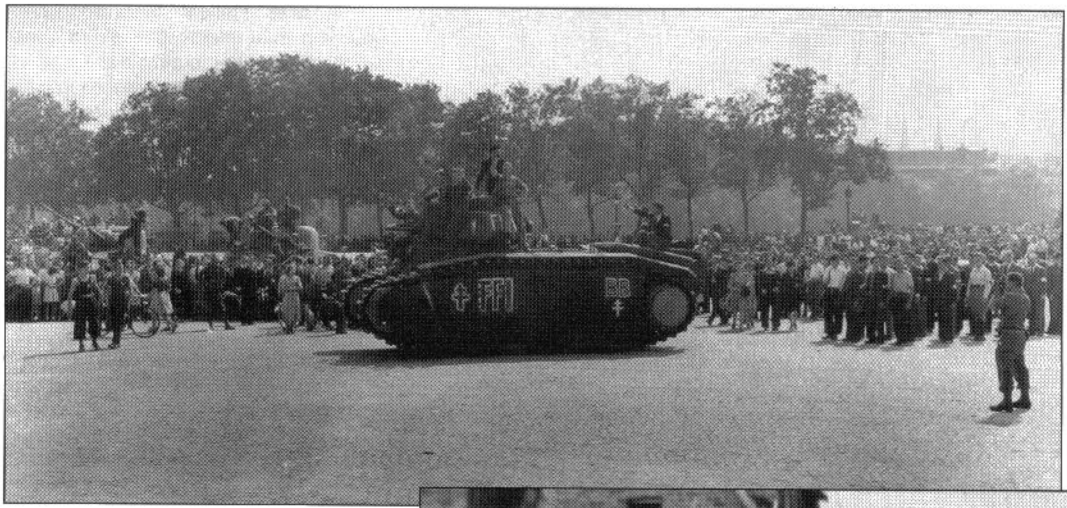
A US column fights through Fountainebleu while supporting the drive of the 2nd French Armored Division to liberate Paris on 23 August 1944. The infantry is being supported by a pair of M10 3-inch tank destroyers. (US Army)



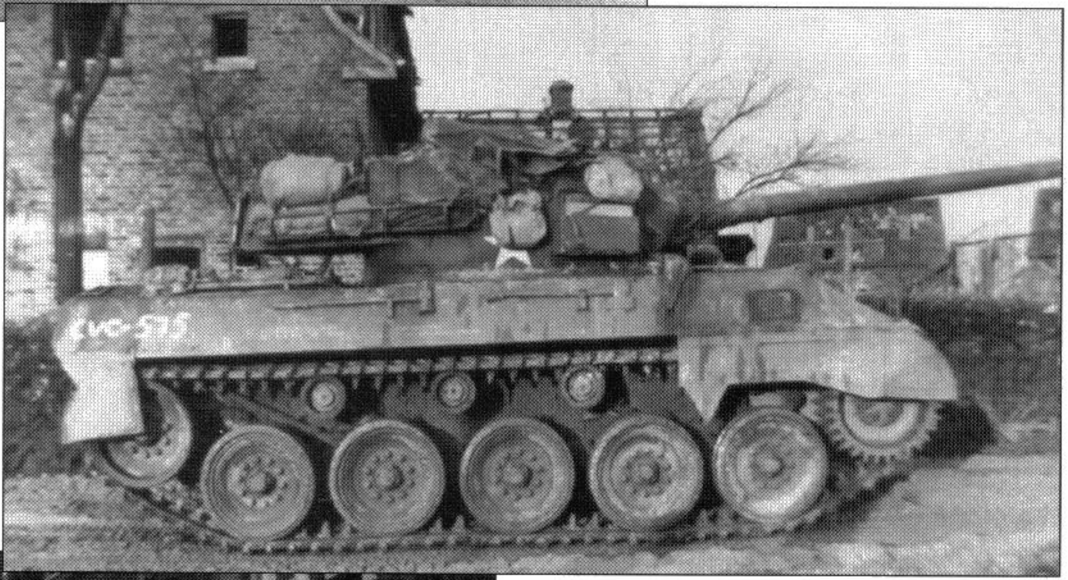
The French 2nd Armored Division broke through to relieve the resistance forces which had seized much of Paris from the Germans in late August. Here we see a M4A2 tank (number 51) of the 12e Regiment des Chasseurs d'Afrique, named Franche-Comte being enthusiastically received by the citizens of Paris. (US Army)



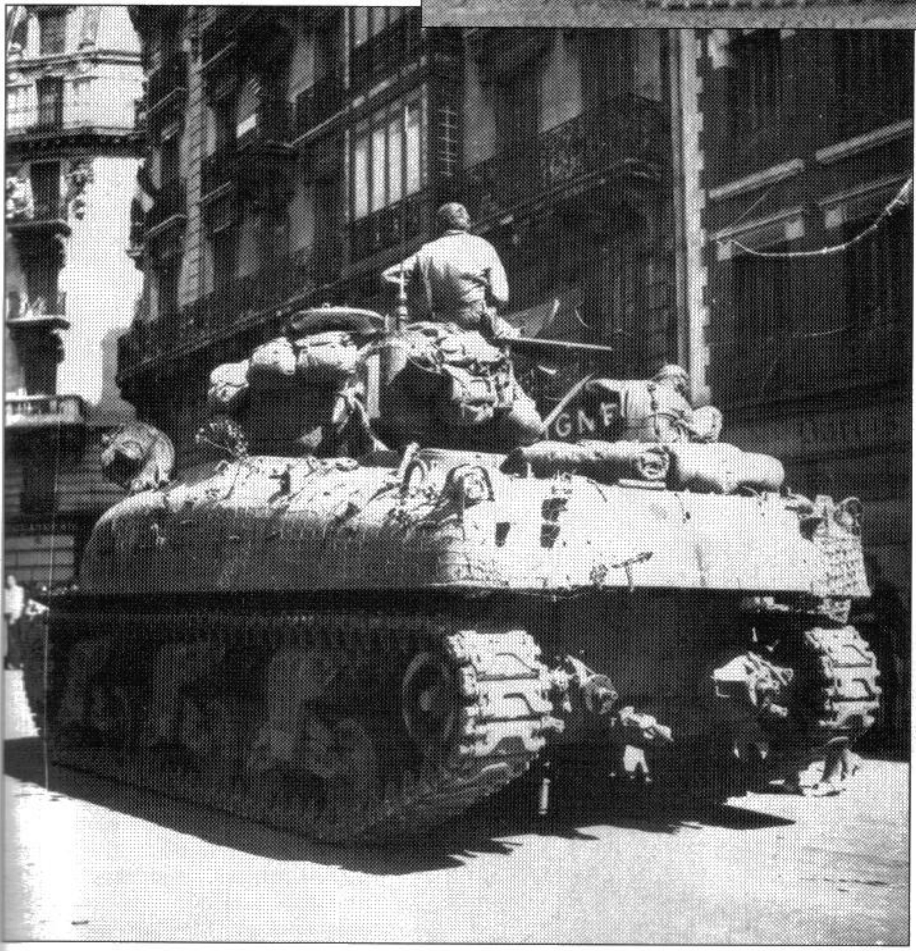
A M4A2 Sherman supports a column of half-tracks from the Regt. de Marche de Tchad near the Lion of Belfort monument, commemorating the 1870-71 Franco-Prussian war. German resistance in Paris was weakened by the wholesale retreat of many Wehrmacht support units. (US Army)



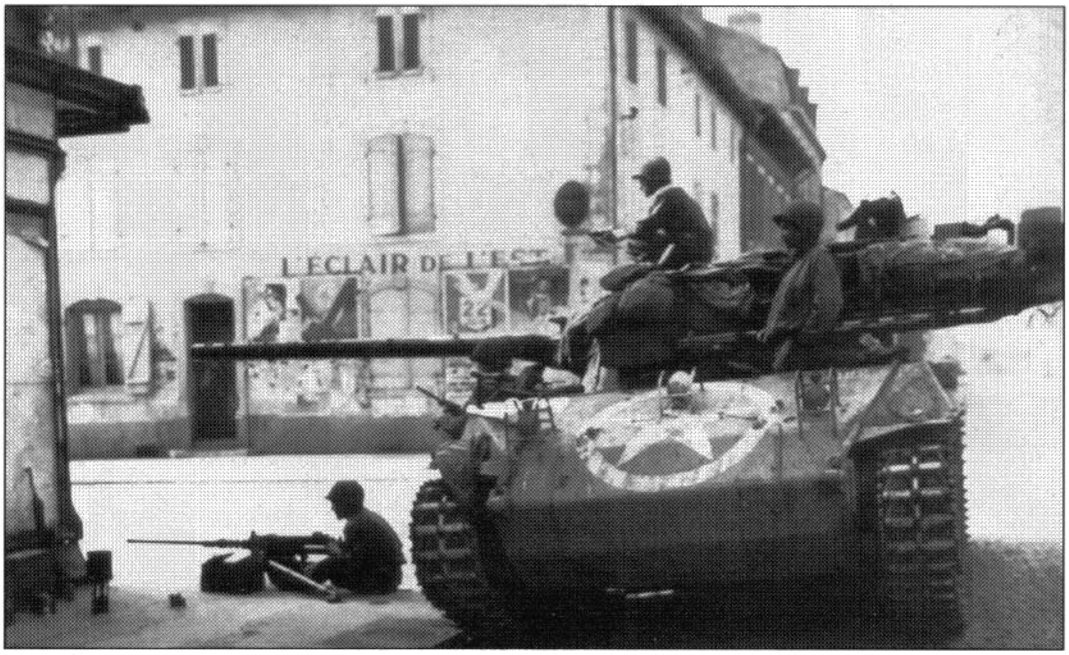
Crowds gather in the plaza in front of Notre Dame cathedral on Isle de la Cite in the center of Paris on 26 August to celebrate the liberation. Aside from the M4A2s of the 2nd Armored Division, also present is a Char B1 bis tank captured by the FFI (French Forces of the Interior) resistance group. This tank had been in German service as is evident from the tool fittings. Aside from the FFI markings, the tank is also bedecked with Gen. Charles DeGaulle's Cross of Lorraine insignia. (US Army)



One of the last hold-outs on the Breton coast was the seaport of Brest, where much of the German Atlantic fleet was stationed. US forces beseiged the port through much of September, including this M18 Hellcat 76mm tank destroyer. (US Army)

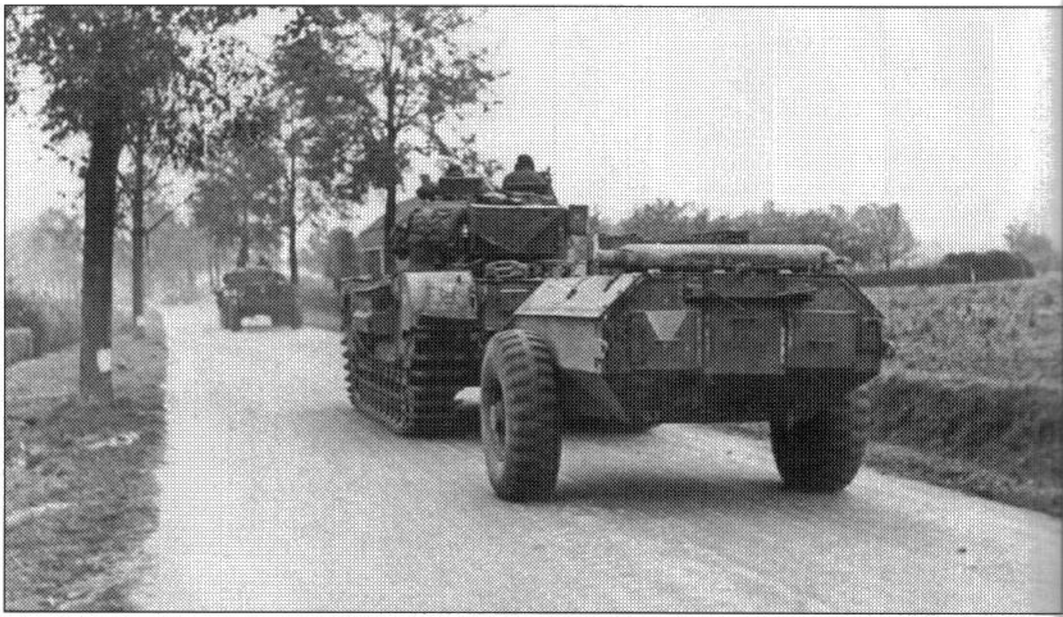


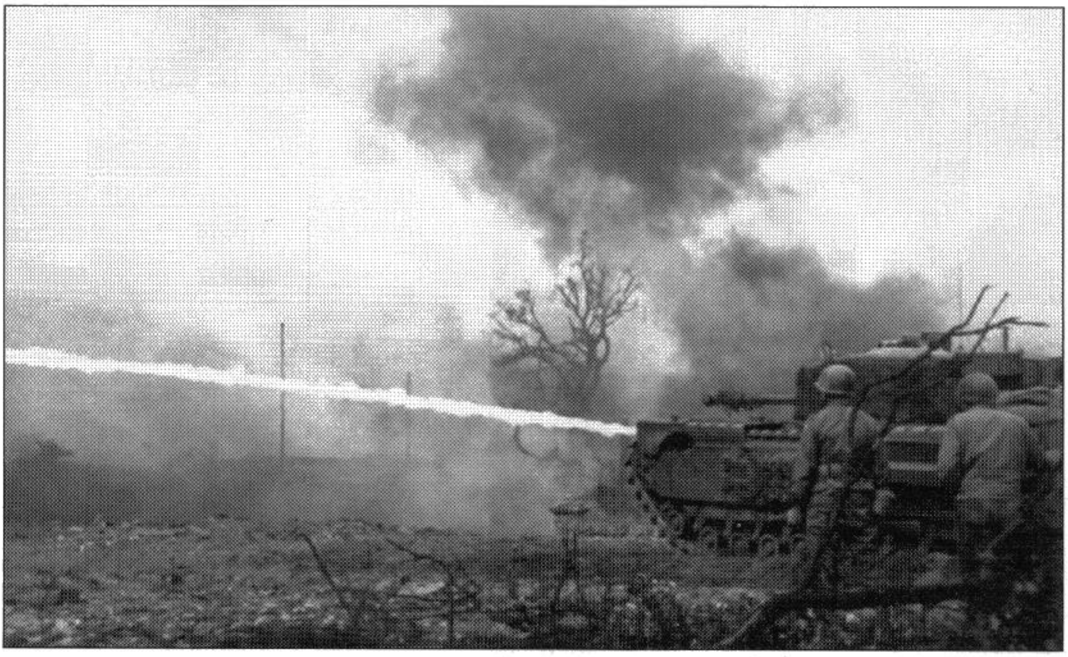
This M4A1 Duplex Drive has driven a long way since the landings at Normandy almost two months before. This is a very late production M4A1 with the 75mm gun, but featuring the revised hull with wet stowage. The Duplex Drive equipment has been almost completely removed, except for the power trains for the propellor at the rear. The tank has been draped with chicken wire to attach foliage for camouflage. (USS Intrepid Museum)



A M18 Hellcat tank destroyer guards a road intersection in Frambois on 22 September during the siege of the Brest sea port. Brest was sought by the Allies due to its excellent port facilites, but the Germans managed to sabotage much of the harbor before surrendering. (US Army)

On encountering tough German resistance from concrete defenses around the port, the US Army requested the assistance of tank-mounted flamethrowers from the British 79th Armoured Division, since the US armored division had no such weapons in France. Here, a pair of Churchill Crocodiles move towards Brest. (The Tank Museum)

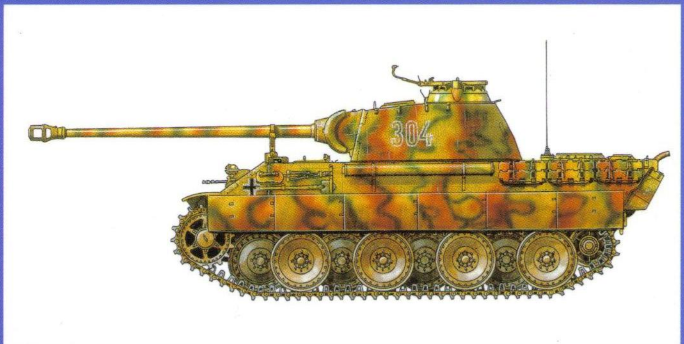


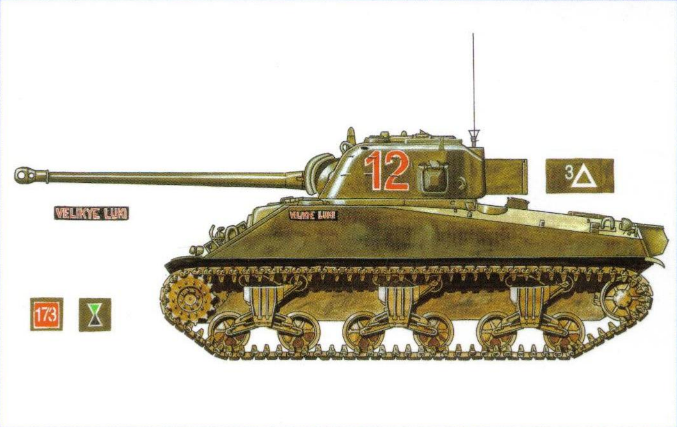


The Churchill Crocodiles were temporarily attached to a 4th Armored Division group trying to reduce German pockets of resistance in Brest. The Crocodile mounted a flamethrower in the glacis plate in place of the usual machine gun, and an armored trailer in the rear provided the fuel and pressurized air. (The Tank Museum)

D-DAY TANK WARFARE

ARMORED COMBAT IN THE NORMANDY CAMPAIGN JUNE-AUGUST 1944

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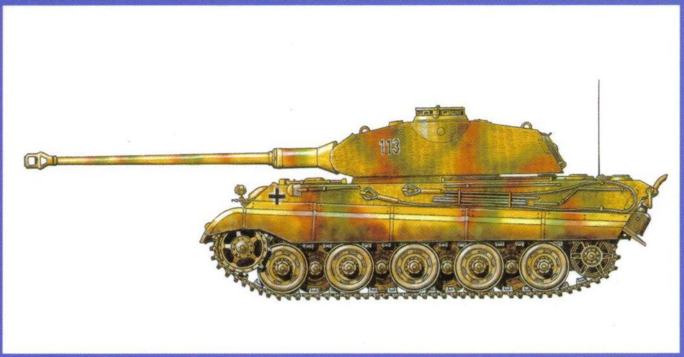

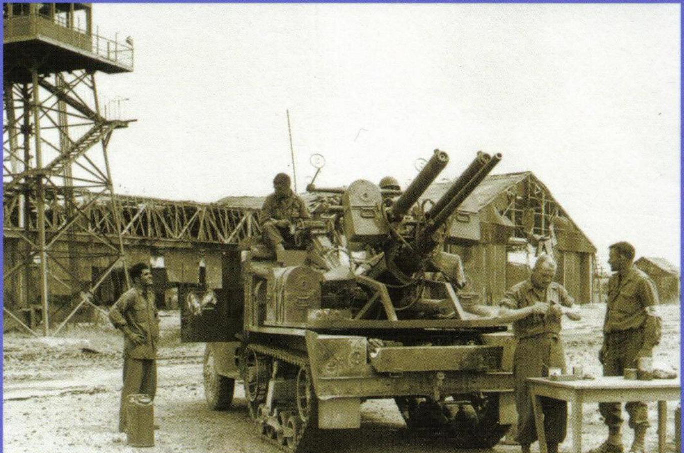

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